

DC-DC Converter Non-isolated**LDE50-5S3V3V****3.0Vdc to 5.5Vdc Input; 0.8Vdc to 3.63Vdc/15A Output****RoHS Compliant****Applications**

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

Features

- Compliance with RoHS EU Directive 2002/95/EC
- Compliance with Lead free wave soldering environment
- Delivers up to 15A output current
- High efficiency: up to 94% at 3.3V full load
- Small size and profile: 1.9 * 0.5 * 0.3 max inch
- Low output ripple and noise
- switching frequency 300kHz
- High reliability: MTBF > 2,000,000h at 25 °C
- Remote On/Off negative logic
- Remote Sense
- Adjustable Output voltage
- Input under voltage protection
- Output overcurrent protection
- Short circuit protection
- Over temperature protection
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with and licensed for Basic Insulation rating per IEC60950 3rd edition
- ISO 9001:2000 Certificate HK03/0436
- ISO 14001:2004 Certificate HK06/01652
- OHSAS 18001:2007 Certificate CN09131988

Description

LDE50-5S3V3V is a SIP Non-isolated DC/DC converter. It can operate from 3.0 Vdc ~5.5Vdc input and 0.8Vdc~ 3.63 Vdc/5A output. The converter can achieve ultra high efficiency reaching 94% at 3.3Vdc full load output. The remote control logic is negative. The converter turns on when the REM pin is left open or at logic low(0~0.3Vdc)and turns off when it is at logic high(2.5~5.5Vdc).The output is 0.75V when the TRIM pin is left open and goes high when it is connected to GND through an external resistance. The values of normal output voltage are 0.75V/1.2V/1.5V/1.8V/2.5V/3.3V.

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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.	Typ.	Max.	
Input Voltage	Vdc	-	-	5.5	Continuous
		-	-	6.0	Transient (100ms)
Operating Ambient Temperature	℃	-40	-	85	
Storage Temperature	℃	-55	-	125	
Humidity	RH(%)	0		95	

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	Vdc	3.0	5.0	5.5	Vo1≤2.5Vdc
		4.5	5.0	5.5	Vo1>2.5Vdc
Maximum Input Current	A	-	10.6	14	Vin=Vin(min) to Vin(max), Io=Io(max)
Input No load Current	mA	-	70	200	Vin=Vin(min) to Vin(max), Io=0, module enabled
Input Reflected Ripple Current Peak-to-Peak	%	-	-	1	>500KHz, 12uH impedance, 1uF ceramic and 47uF(ESR <0.7Ω)aluminum electrolytic capacitor
Inrush Transient	A ² S	-	-	0.1	

Remote Control Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Turn on voltage	Vdc	0	-	0.3	converter turns on when the REM pin is left open
Turn off voltage	Vdc	2.5	-	5.5	

Output Characteristics

Parameter	Units	Specifications	Notes & conditions
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		Min.	Typ.	Max.	
Output Voltage Set-Point	Vdc	0.776	0.8	0.824	Vin=Vin(min) to Vin(max) Io=0 to Io(max) Vin ≥ Vo+0.5V
		1.164	1.2	1.236	
		1.455	1.5	1.545	
		1.746	1.8	1.854	
		2.425	2.5	2.575	
		3.201	3.3	3.399	
Output Current	A	-	-	15	Io= Io(max)
Line Regulation	%Vo	0	0.2	0.5	Vin=Vin(min) to Vin(max) Io=Io(max)
Load Regulation	%Vo	0	0.4	1	Vin=Vin(nom) Io=0 to Io(max)
Output Voltage Precision	%Vo	0	-	3	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Remote sense range	Vdc	0	-	0.5	
Output Current Limit	A	16.5	-	30	baseplate temperature above 85°C
Temperature Coefficient	%/°C	-	-	0.02	Ambient Temperature -40°C ~ 85°C
External Capacitive load	μF	-	4700	-	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Dynamic Response	%Vo /μs	-	-	5/100	25%~50%~100%Io(nom) load stepped, di/dt=0.1A/μS Add 100μF Tantalum capacitor at input and output
	mV/μs	-	-	150/160	Vin=3.0V, Vo=2.5V 25%~50%~100%Io(nom) load stepped, di/dt=0.1A/μS Add 100μF Tantalum capacitor at input and output
Ripple and Noise	mV	-	25	50	Measured with 10uF Tantalum and 1uF Ceramic external capacitor in parallel
Turn-on Delay Time	ms	-	4	-	Delay from instant at which Vin=Vin(min) until Vo=0% of Vo(nom)
Turn-on Rise Time	ms	-	4	-	Time for Vo to rise from 10% of Vo(nom) to 90% of Vo(nom)

Protection Characteristics

Parameter	Units	Specifications	Notes & conditions
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		Min.	Typ.	Max.	
Input turn-on voltage	Vdc	2.25	2.75	3.0	$V_o \leq 2.5VDC$
	Vdc	—	3.70	4.5	$V_o > 2.5VDC$
Input Undervoltage Lockout	Vdc	1.8	2.0	3.0	$I_o = 0$ to $I_o(max)$
Output Over current Protection		-	Y	-	baseplate temperature above 85°C
Short Circuit Protection	Hours	4	-	-	Hiccup mode Automatic recovery
Overtemperature Protection	°C	-	125	150	Chip case temperature Automatic recovery
Overtemperature Protection Hysteresis	°C	-	10	15	

General Specifications

Parameter		Units	Specifications			Notes & conditions
			Min.	Typ.	Max.	
Efficiency	$V_o = 0.75V$	%	78	81	-	$V_{in} = V_{in}(nom)$ $I_o = I_o(max)$,
	$V_o = 1.2V$		84	87	-	
	$V_o = 1.5V$		86	89	-	
	$V_o = 1.8V$		88	90	-	
	$V_o = 2.5V$		90	92	-	
	$V_o = 3.3V$		93	94	-	
MTBF		Hours	-	2,000,000	-	Bellcore TR332, 25°C
Weight		g	6.9			
Moisture Sensitivity Level			Level 1			
Safety			Compliant to IEC60950-1, UL60950-1, EN60950-1 and GB4943			
Vibration			IEC68-2-6			

Characteristic Curves

The following figures provide typical characteristics for the LDE50-5S3V3 module at ambient temperature 25°C.

Characteristic Curves (Efficiency)

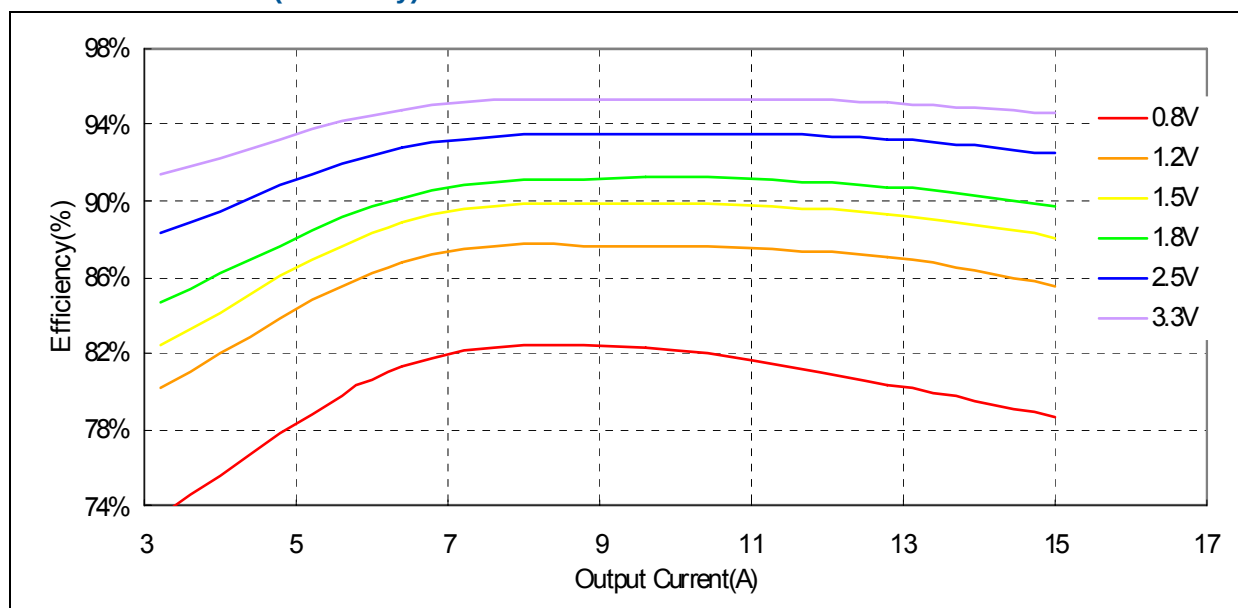


Figure 1. Efficiency vs. Output Current

Characteristic Curves (Derating)

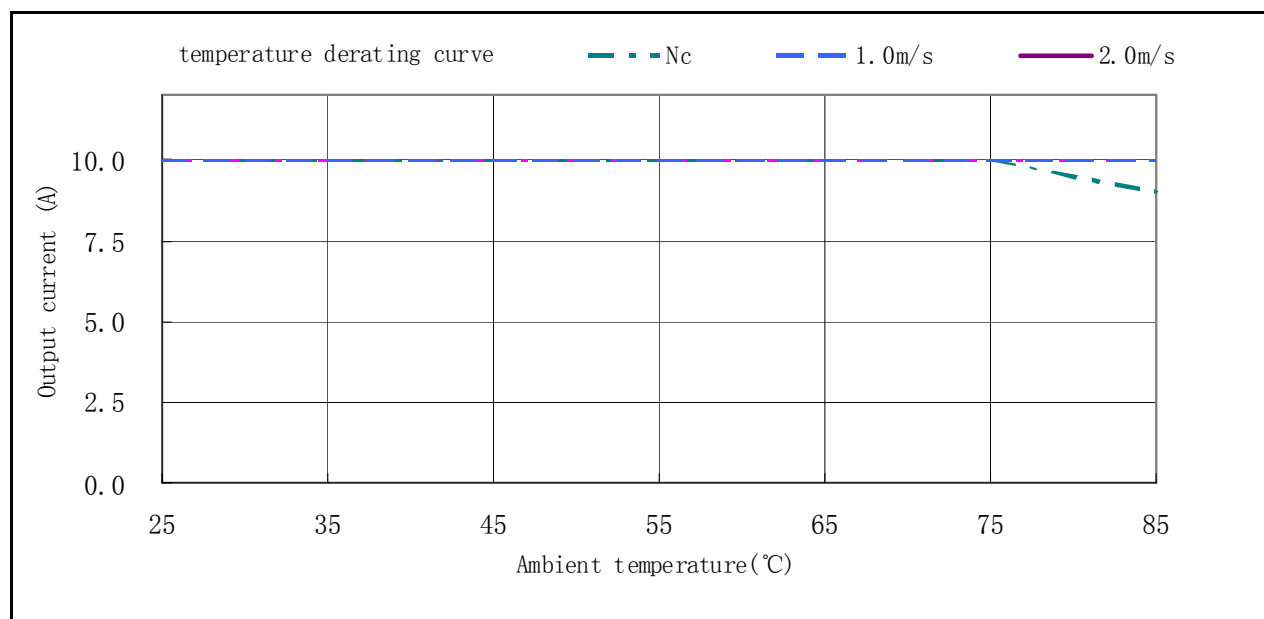


Figure2. Converter Derating Curve (Vin=5V, Vout=3.3V)

Characteristic Curves (Start-up)

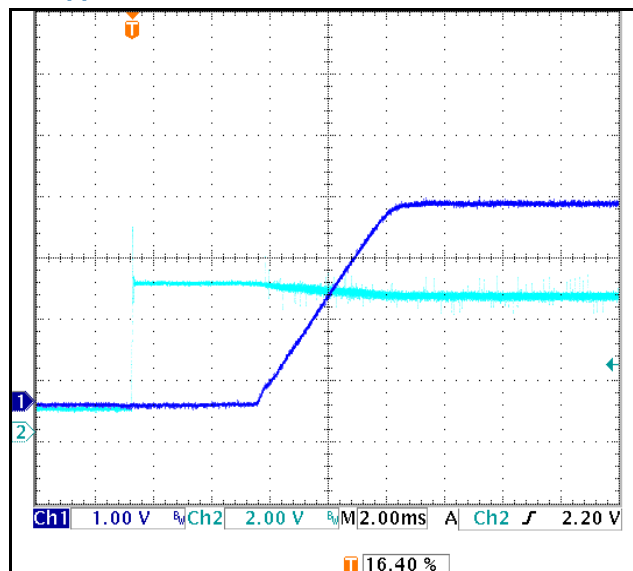


Figure3. Typical Start-up using Input Voltage

Characteristic Curves(Ripple, Peak to peak)

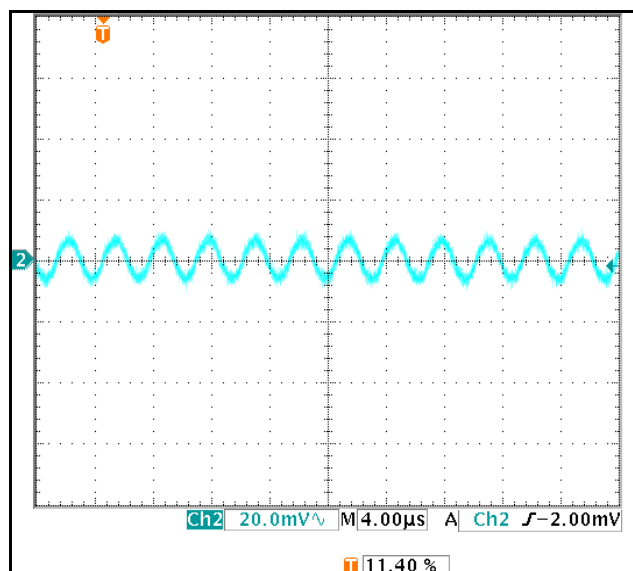


Figure4. Output ripple voltage

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Characteristic Curves (Dynamic Response)

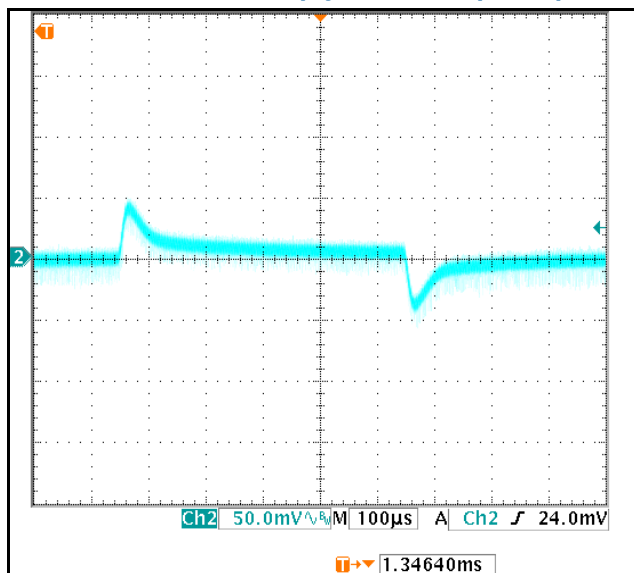


Figure5. 25%~50% load stepped ($V_{in}=3.0V/V_o=1.5V$)

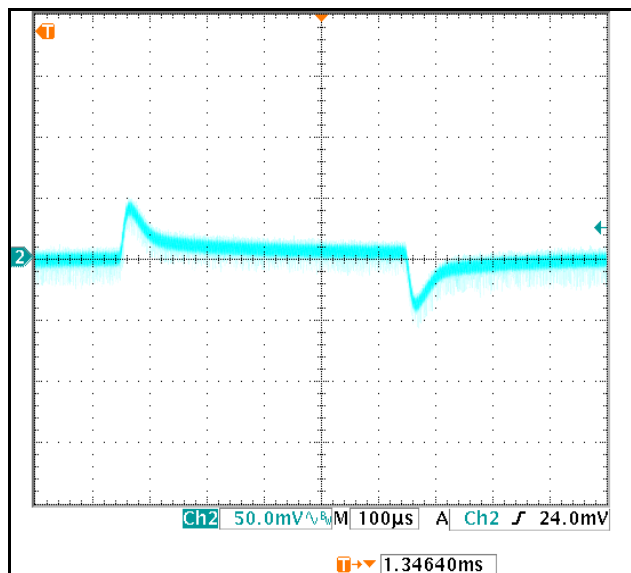
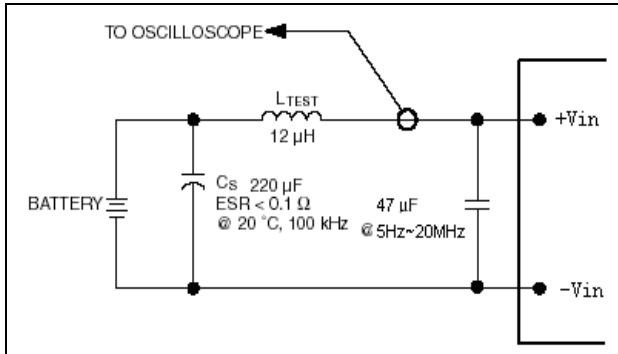


Figure6. 50%~75% load stepped ($V_{in}=4.5V/V_o=3.3V$)

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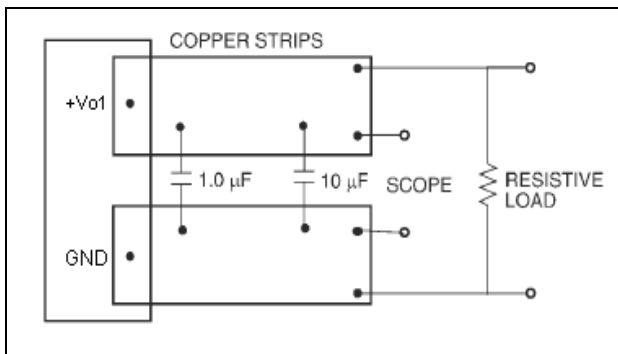
Technical Specification LDE50-5S3V3V

Test Configurations



Note: Measure input reflected ripple current with a simulated source inductance (L_{TEST}) of 12 μ H. Capacitor C_s offsets possible battery impedance. Measure the current as shown above.

Figure 7. Input Reflected Ripple Current Test Setup



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

Figure 8. Peak-to-Peak Output Ripple Test Setup

Safety Considerations

For safety agency approval the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards, i.e., UL 60950-1, CSA C22.2 No. 60950-1-03, and VDE 0850:2001-12 (EN60950-1) Licensed.

For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements. The power module

has extra-low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a fast acting fuse with a maximum rating of 20A in the positive input lead.

Design Considerations

Input and Output Filter

The power module should be connected to a low ac-impedance input source. A highly inductive source can affect the stability of the power module. An input capacitor must be placed directly adjacent to the input pin of the module, to minimize input ripple voltage and ensure module stability. If you have more requirement of EMC, additional inductance is also needed.

To reduce the output ripple and improve the dynamic response to a step load change, additional capacitor at the output can be used. For stable operation of the module, limit the capacitor to less than the maximum output capacitor as specified in the electrical specification table. Figure 9 shows the typical application circuit with input and output filters.

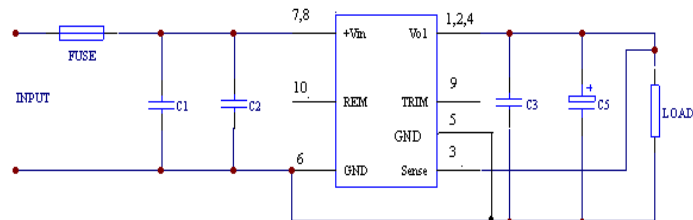


Figure 9. Typical application circuit

The Table below provides the recommended rating for use with this family of products.

Component	Recommended Rating
FUSE	20A/32V
C1	2×47 μ F polyester capacitor
C2	2×150 μ F electrolytic capacitor
C3	1 μ F ceramic capacitor
C4	10 μ F tantalum capacitor

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Feature Descriptions

Remote On/Off

The power module features an On/Off pin (REM) for remote On/Off control of the module. The remote On/Off operation is available by using a MOSFET with an external pull-up resistor (see Figure 10). The MOSFET keep the dissipation to a minimum, and the pull-up resistor is typically set at 5kΩ for proper operation of module over the entire temperature range.

To turn the module on, the REM pin should be left open or at logic low (0~0.3Vdc), and to turn the module off, the REM pin should be at logic high (2.5~5.5Vdc)

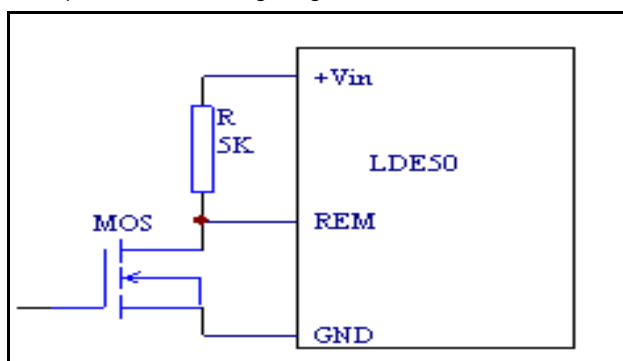


Figure 10. Remote On/Off Application Circuit

Remote Sense

The products incorporate an output voltage sense pin, Sense. The Sense pin should be connected to Vo1 at the load circuit. A remote sense improves the load regulation performance of the module by allowing it to compensate for any 'IR' voltage drop between itself and the load. An IR drop is caused by the high output current flowing through the small amount of pins and trace resistance. Use of the remote sense is optional. If not used, the Sense pin can be left open. An internal low value resistor (15-Ω or less) is connected between the Sense and Vo1. This ensures the output voltage remains in regulation.

With the sense pin connected, the difference between the voltage measured directly between the Vo1 and GND pins, and that measured from Sense to GND, is the amount of IR drop being compensated by the regulator.

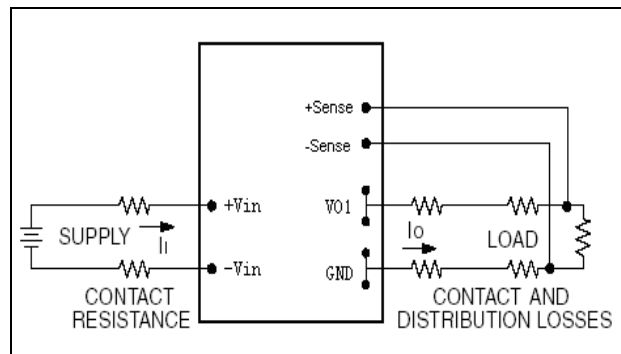


Figure 11. Effective Equivalent Circuit Configuration for Remote-Sense

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 Vo1 or GND pins.

To increase the output voltage, A trim resistor, R_{TU} is connected between the TRIM and GND.

$$R_{TU} = 10^5 \frac{7.70 - 2.08V_O}{1.69V_O - 5.58} \Omega$$

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

V_O = Desired (trimmed) output voltage [V].

Trimming beyond 110% of the rated output voltage is not an acceptable design practice. When trimming up, care must be taken not to exceed the converter's maximum allowable output power.

To decrease the output voltage, a trim resistor, R_{TD} , should be connected between the TRIM and Vo1, with a value of

$$R_{TD} = 10^5 \frac{7.70 - 9.91V_O}{1.69V_O - 5.58} \Omega$$

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

V_O = Desired (trimmed) output voltage [V].

Protection Features

Input Undervoltage Lockout

At input voltages below the input under-voltage lockout limit,

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the module operation is disabled. The module will begin to operate at an input voltage above the under-voltage lockout turn-on threshold.

Output Overcurrent Protection

To provide protection in an output overload fault condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for an unlimited duration. At the instance of current-limit inception, the module enters a "hiccup" mode of operation, whereby it shuts down and automatically attempts to restart. While the fault condition exists, the module will remain in this mode until the fault is cleared. The unit operates normally once the output current is reduced back into its specified range.

Overtemperature Protection

These modules feature an over-temperature protection circuit to safeguard against thermal damage. The circuit shuts down and latches off the module when the maximum device reference temperature is exceeded. The module can be restarted by cycling the dc input power for at least one second or by toggling the remote on/off signal for at least one second.

Thermal Considerations

Modules operate in a variety of thermal environments; however, sufficient cooling should always be provided to help ensure reliable operation. 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 and up to 2m/s

are shown in the Characteristics Curves section.

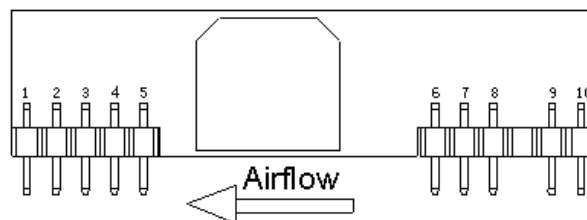


Figure 11. Recommended Airflow Direction

Soldering Information — Through hole mounting

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 260 °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.

Technical drawing of the SUPLET® Name Panel. The drawing includes a side view on the left and a top view on the right. Dimensions are provided in millimeters (mm) and inches (in).

Side View Dimensions:

- Overall height: 7.52 [0.30] Max
- Mounting hole diameter: 5.0 [0.20] Max
- Mounting hole offset from left edge: 0.64 [0.03]

Top View Dimensions:

- Overall width: 50.8 [2.00]
- Overall height: 12.7 [0.50]
- Panel width (excluding pins): 48.26 [1.90]
- Pin pitch (between groups of 5 pins): 2.54 [0.10]
- Pin pitch (within each group of 5 pins): 0.64 [0.03]
- Pin length (from panel surface): 2.54 [0.10]
- Pin diameter: 0.64 [0.03]
- Panel thickness: 3.3 [0.13] ± 0.2

The panel features a central label area with the text "SUPLET®" and "NAME PANEL". The pins are numbered 1 through 10, with pins 1-5 on the left and pins 6-10 on the right.

Note: Dimensions are in mm [inch]. Tolerances: x.x mm $\pm$ 0.5mm [x.x in. $\pm$ 0.02 in.],
x.xx mm $\pm$ 0.25 mm [x.xxx in. $\pm$ 0.010in.] (Unless otherwise indicated)

Pins No.	Symbols	Functions
1,2,4	Vo1	Positive output
3	Sense	Output voltage compensation
5,6	GND	Negative input and output
7,8	+Vin	Positive input
9	TRIM	Adjustable Output voltage
10	REM	Remote control

Recommended Pad Layout

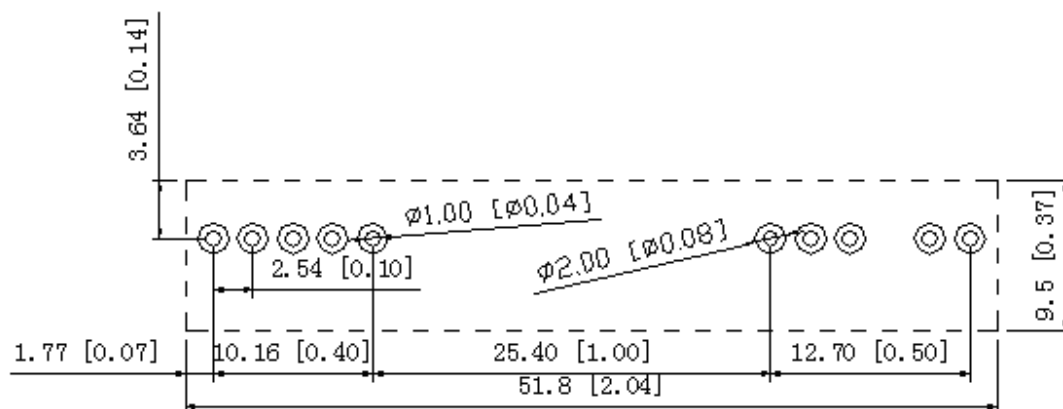


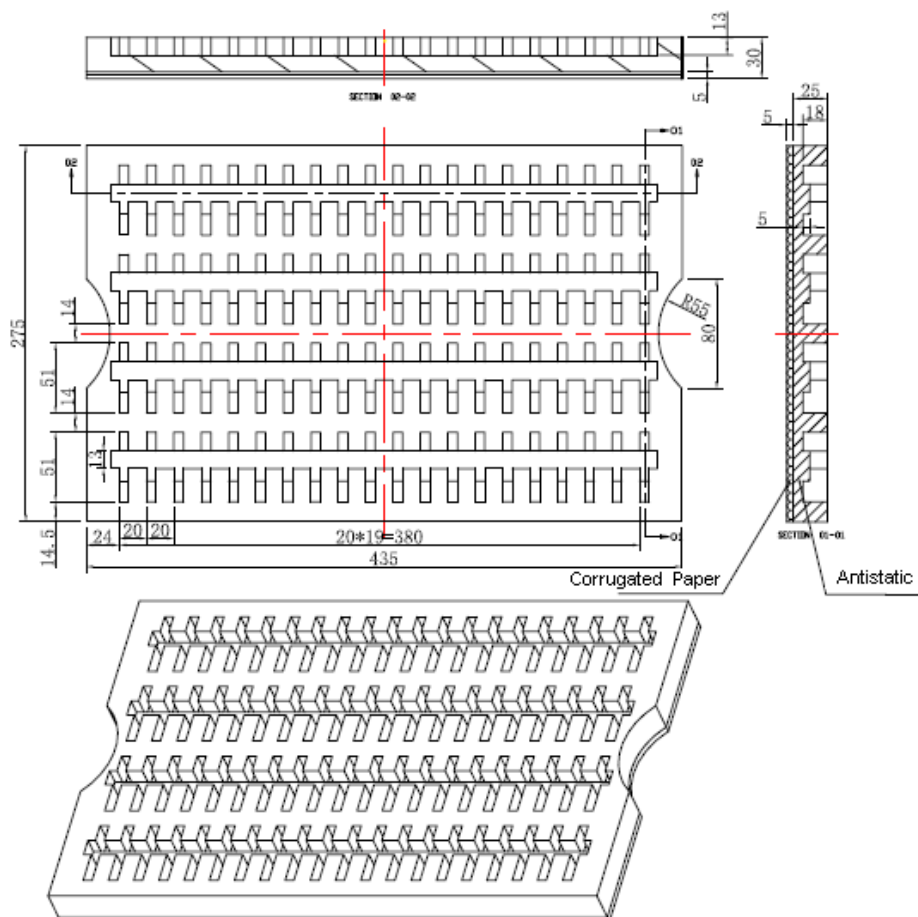
Figure13. Recommended Pad Layout

Note: Dimensions are in mm [inch]. Tolerances: x.x mm $\pm$ 0.5mm [x.x in. $\pm$ 0.02 in.],
x.xx mm $\pm$ 0.25 mm [x.xxx in. $\pm$ 0.010 in.] (Unless otherwise indicated)

Packaging Details

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

Tape Dimensions

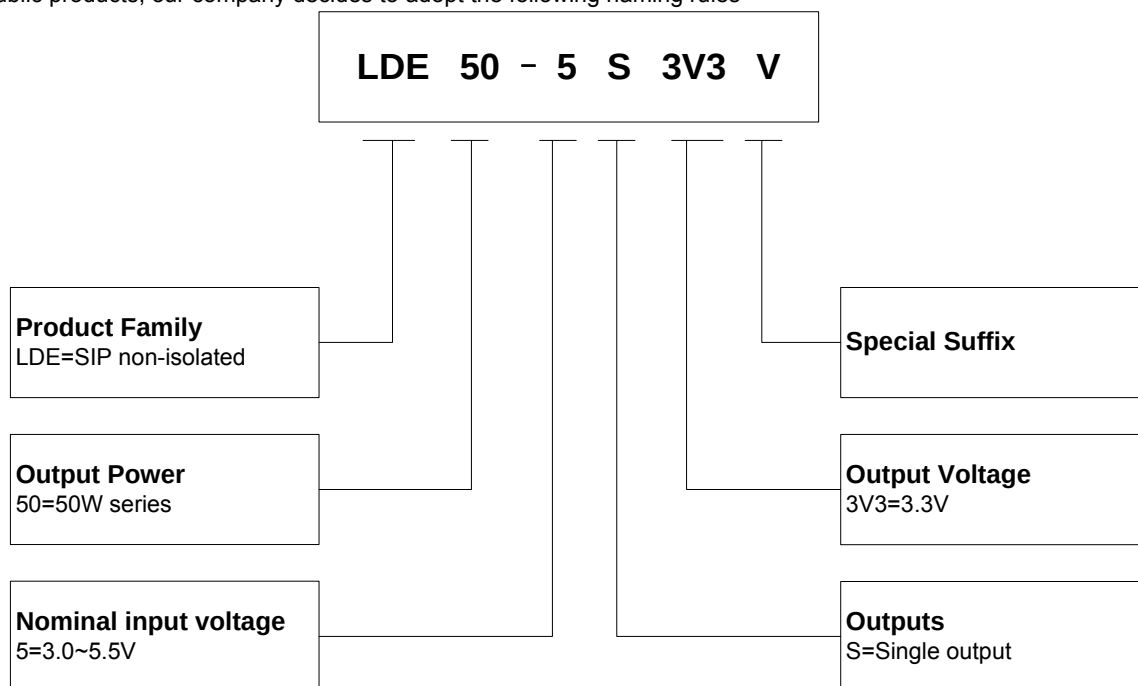


Tray Specifications

Material	PPE ,antistatic
Surface resistance	$<10^{10}\text{Ohm}$
Bakability	The trays can be baked at maximum 125°C for 48 hours maximum
Tray capacity	80 products/tray
Box capacity	320 products 4 full trays/box
Tray weight	720g full tray, 165g empty tray

Naming Rules On Models

For public products, our company decides to adopt the following naming rules



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