SUPLET®

Technical Specification

DC-DC Converter POL

LDES75-5S0V75N

3.0Vdc to 5.5Vdc Input；0.75Vdc to 3.63Vdc/24A Output

RoHS Compliant

Features

- Compliance with RoHS10 EU Directive 2011/65/EU & 2015/863/EU
- Delivers up to 24A output current
- High efficiency: up to 95% at 3.3V full load
- Small size and profile: 1.30×0.53×0.33(inch)
- Low output ripple and noise
- Wide operating temperature range
- Constant switching frequency 300kHz
- High reliability
- Remote On/Off positive logic
- Remote Sense
- Output voltage adjustable
- Input under voltage protection
- Output over current protection
- Short circuit protection
- Over temperature protection

Applications

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

Description

LDES75-5S0V75N is a SMT Non-isolated DC/DC converter. It can operate from 3.0 Vdc ~5.5Vdc input and 0.75Vdc~ 3.63 Vdc/24A output. The converter can achieve ultra high efficiency reaching 95% at 3.3Vdc full load output. The remote control logic is positive. The converter turns on when the REM pin is left open and turns off when it is at logic low (0～0.3Vdc/1mA). 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.

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	
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	Vdc	3.0	5.0	5.5	Vo1≤2.5Vdc
		4.5	5.0	5.5	Vo1>2.5Vdc
Maximum Input Current	A	-	-	25	Vin=Vin(min) to Vin(max), Io=Io(max)
Input No load Current	mA	-	-	200	Vin=Vin(min) to Vin(max), Io=0, module enabled
Input Reflected Ripple Current Peak-to-Peak	%	-	-	1	5 Hz to 20 MHz, 12 μH source impedance,47μF (ESR<0.7Ω)aluminum

					electrolytic capacitor
Inrush Transient	A^2S	-	-	0.1	

Remote Control Characteristics

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

Output Characteristics

Parameter	Units	Specifications			Notes & conditions
		Min.	Typ.	Max.	
Output Voltage Set-Point	Vdc	0.725	0.75/1.2/1.5/1.8/2.5/3.3	3.63	Io=0 to Io(max)
Output Current	A	-	-	24	Io= Io(max)
Line Regulation	%Vo	-	0.3	-	Vin=Vin(min) to Vin(max) Io=Io(max)
Load Regulation	%Vo	-	0.4	-	Vin=Vin(nom) Io=0 to Io(max)
Output Voltage Precision	%Vo	-	-	3	Vin=Vin(min) to Vin(max) Io=0 to Io(max)
Output Current Limit	A	26.4	32	-	
Temperature Coefficient	%/℃	-	-	0.02	Ambient Temperature -40℃～85℃
Dynamic Response	mV/μs	-	±200/100	-	25%~50%~75%Io(nom) load stepped, di/dt=2.5A/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
			Min.	Typ.	Max.	
Input Under voltage Lockout	Turn-on Threshold	Vdc	1.90	2.75	3.0	Vo≤2.5Vdc
			1.90	3.70	4.5	Vo>2.5Vdc
	Turn-off Threshold	Vdc	1.80	2.05	3.0	Io= Io(max)
Output Overcurrent Protection			-	Yes	-	Hiccup mode Automatic recovery
Short Circuit Protection		Hour	4	-	-	Hiccup mode Automatic recovery
Overtemperature Protection		℃	-	125	-	Automatic recovery See OTP section
Overtemperature Protection Hysteresis		℃	0	10	-	

General Specifications

Parameter		Units	Specifications			Notes & conditions
			Min.	Typ.	Max.	
Efficiency	Vo=0.75V	%	-	81	-	Ambient Temperature 25℃, Io=Io(nom), Vin=3.3Vdc/ Vin=5.0Vdc
	Vo=1.2V		-	87.5	-	
	Vo=1.5V		-	89.5	-	
	Vo=1.8V		-	90.5	-	
	Vo=2.5V		-	93	-	
	Vo=3.3V		-	95	-	
MTBF		Hour	2,000,000			Telcordia SR332, Issue3, 2011, 40℃
FIT			500			10^9/MTBF
Switching Frequency		KHz	250	300	350	Constant frequency

Thermal Stability Time	min	-	30	-	
Weight	g	6.8			
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				

Characteristic Curves

Start-up

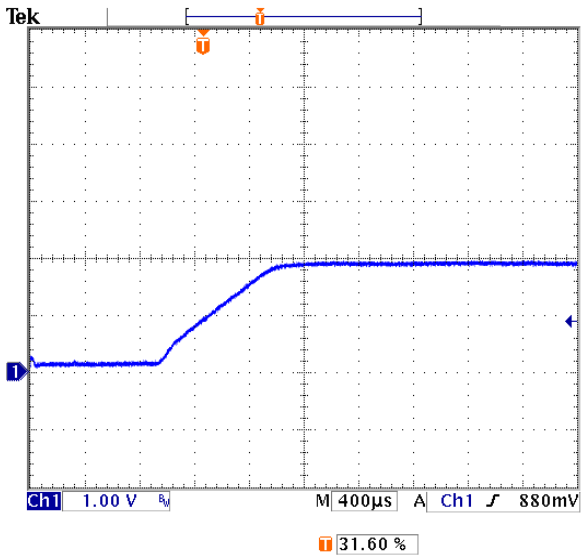


Figure1. Typical Start-up using Input Voltage

Ripple, peak to peak

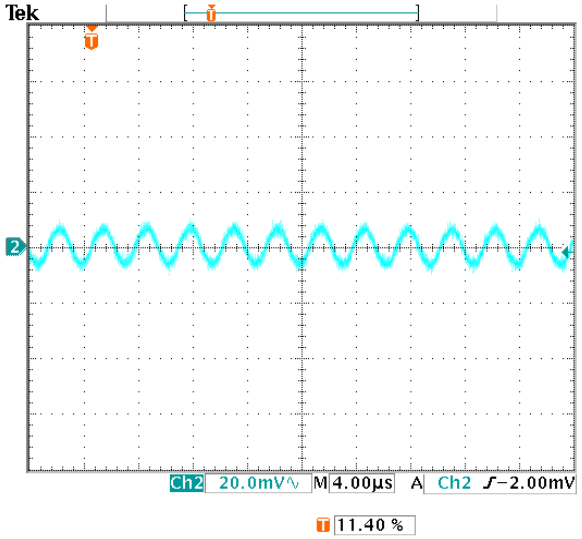


Figure2. Output ripple voltage

Dynamic Response

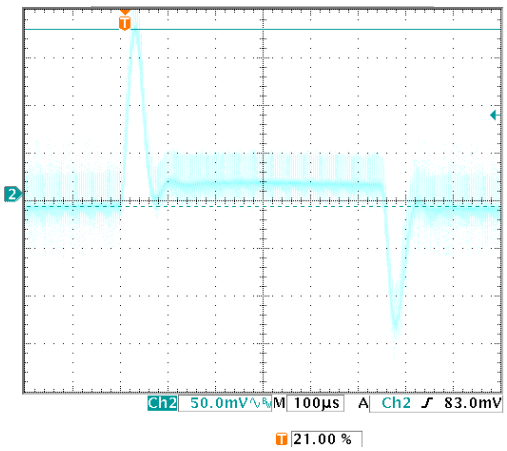


Figure3. Vin=12V/Vo=0.75V, 25%~50%load, 2.5A/µS

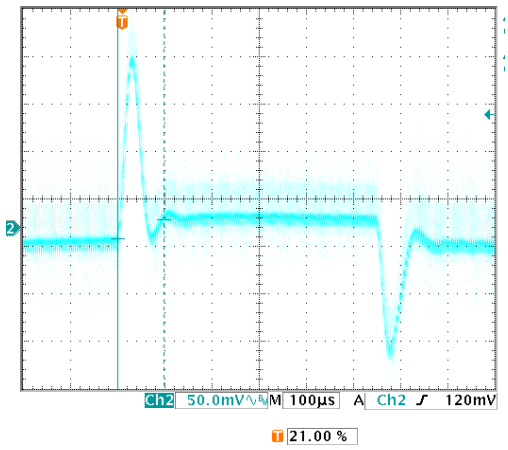
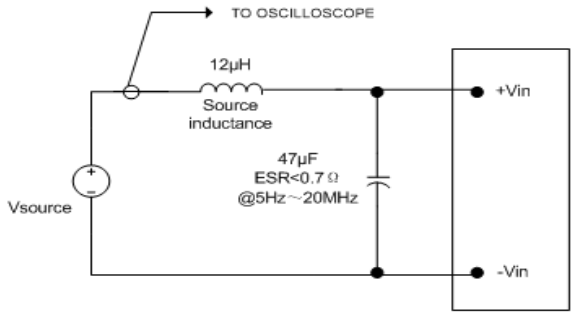


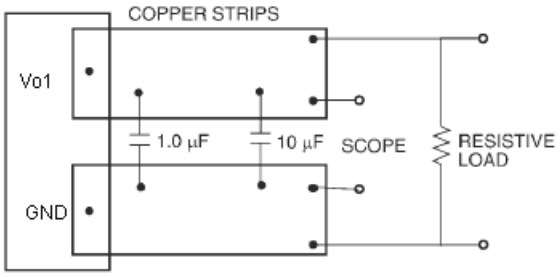
Figure4. Vin=12V/Vo=0.75V, 50%~75%load, 2.5A/µS

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.

Figure 5. 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

Figure 6. 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, *CSA* C22.2, No. 60950-00, and VDE 0805:2001-12 (IEC60950-1 2005).

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 7 shows the typical application circuit with input and output filters.

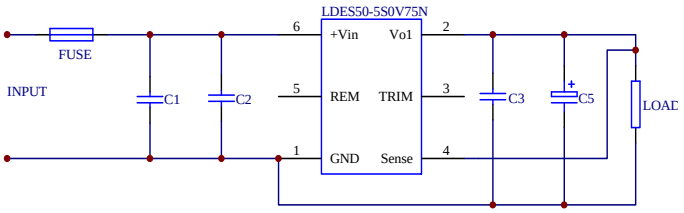


Figure 7. Typical application circuit

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

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

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 8). The MOSFET keep the dissipation to a minimum.
To turn the module on, the REM pin should be left open, and to turn the module off, the REM pin should be at 0-0.3Vdc

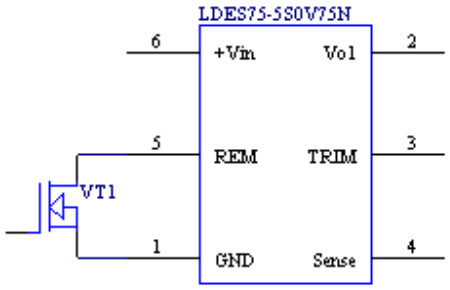


Figure 8. Remote On/Off Application Circuit

Remote Sense

The products incorporate an output voltage sense pin, Sense. The Sense pin should be connected to V_{o1} 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 V_{o1} .This ensures the output voltage remains in regulation.
With the sense pin connected, the difference between the voltage measured directly between the $V_{o1}$and GND pins, and that measured from Sense to GND, is the amount of IR drop being compensated by the regulator. This should be limited to a maximum of 0.3 V.

Output Voltage Programming

The output voltage of the module can be programmed to any voltage from 0.75Vdc to 3.3Vdc by connecting a single resistor R_{adj} between the TRIM and GND pins (shown in Figure 9). Without an external resistor between the TRIM and ground, that is to say, the TRIM pin is left open, the output voltage is 0.75Vdc. To calculate the value of the resistor R_{adj} for a particular output voltage Vo1, use the following equation:

$$R_{adj} = \frac{21.07}{Vo - 0.7525} - 5.11K\Omega$$

Where Vo = output voltage.

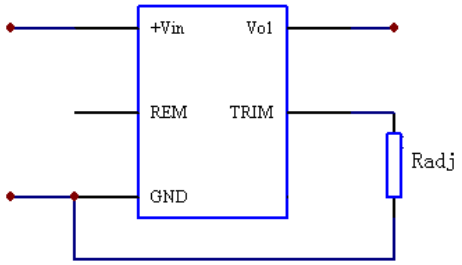


Figure 9. Output voltage programming application

The table below provides the R_{adj} values required for some common output voltages:

Vo (Vdc)	R_{adj} (KΩ)
0.75	NULL
1.2	41.973
1.5	23.077
1.8	15.004
2.5	6.947
3.3	3.160

Protection Features

Input Undervoltage Lockout

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

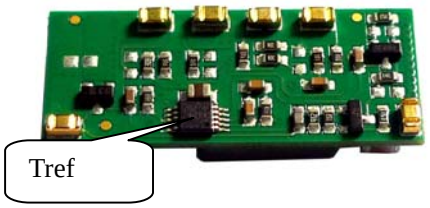
Output Over current Protection

To provide protection in an output overload fault condition, the module is equipped with internal current-limiting circuitry

and can endure current limiting 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.

Over temperature Protection

To provide protection in a fault condition, the unit is equipped with a thermal shutdown circuit. The unit will shutdown if the over temperature threshold is exceeded at the thermal reference point Tref. The thermal shutdown is not intended as a guarantee that the unit will survive temperatures beyond its rating. Once the unit goes into thermal shutdown it will then wait to cool before attempting to restart.



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.

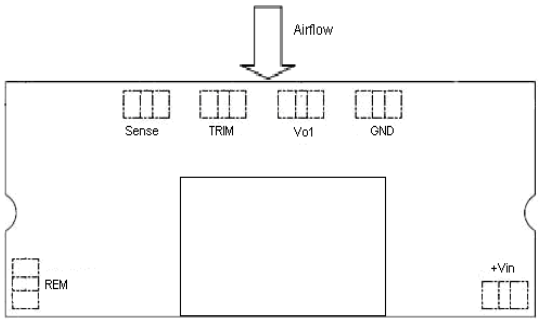


Figure 10.Recommended Airflow Direction

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.

Reflow Soldering Information

These power modules are large mass, low thermal resistance devices and typically heat up slower than other SMT components. It is recommended that the customer review data sheets in order to customize the solder reflow profile for each application board assembly.

The following instructions must be observed when SMT soldering these units. Failure to observe these instructions may result in the failure of or cause damage to the modules, and can adversely affect long-term reliability.

Typically, the eutectic solder melts at 217℃, wets the land, and subsequently wicks the device connection. Sufficient time must be allowed to fuse the plating on the connection to ensure a reliable solder joint. There are several types of SMT reflow technologies currently used in the industry. These surface mount power modules can be reliably soldered using natural forced convection, IR (radiant infrared), or a combination of convection/IR. For reliable soldering the solder reflow profile should be established by accurately measuring the modules pin connector temperatures.

Lead-free (Pb-free) solder processes

For Pb-free solder processes, a pin temperature (T_{PIN}) in excess of the solder melting temperature (T_L, +217 to +221°C for Sn/Ag/Cu solder alloys) for more than 30 seconds, and a peak temperature of +235°C on all solder joints is recommended to ensure a reliable solder joint.

For Pb-free solder processes, the product is qualified for MSL 3 according to IPC/JEDEC standard J-STD-020C. During reflow, T_P must not exceed +245°C at any time.

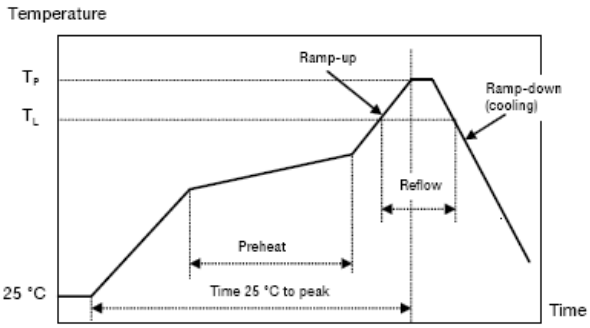


Figure11. Recommended reflow profile.

Reflow process specifications		Pb-free
Average ramp-up rate		3°C/s max
Solder melting temperature (lim)	T_L	+217°C
Time above T_L		30 s~90s
Minimum pin temperature	T_{pin}	+235°C
Peak product temperature	T_p	+245°C
Average ramp-down rate		6°C/s max
Time 25°C to peak		6 minutes max

Storage and Handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 Rev. B (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices). Moisture barrier bags (MBB) with desiccant are required for max. MSL 1 condition. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of ≤ 30°C and 60% relative humidity varies according to the MSL rating (see J-STD-033B).The shelf life for dry packed SMT packages will be a minimum of 12 months from the bag seal date, when stored at the following conditions: < 40° C, < 90% relative humidity.

Post Solder Cleaning and Drying Considerations

Post solder cleaning is usually the final circuit-board assembly process prior to electrical board testing. The result of inadequate cleaning and drying can affect both the reliability of a power module and the testability of the finished circuit-board assembly.

Outline Diagram

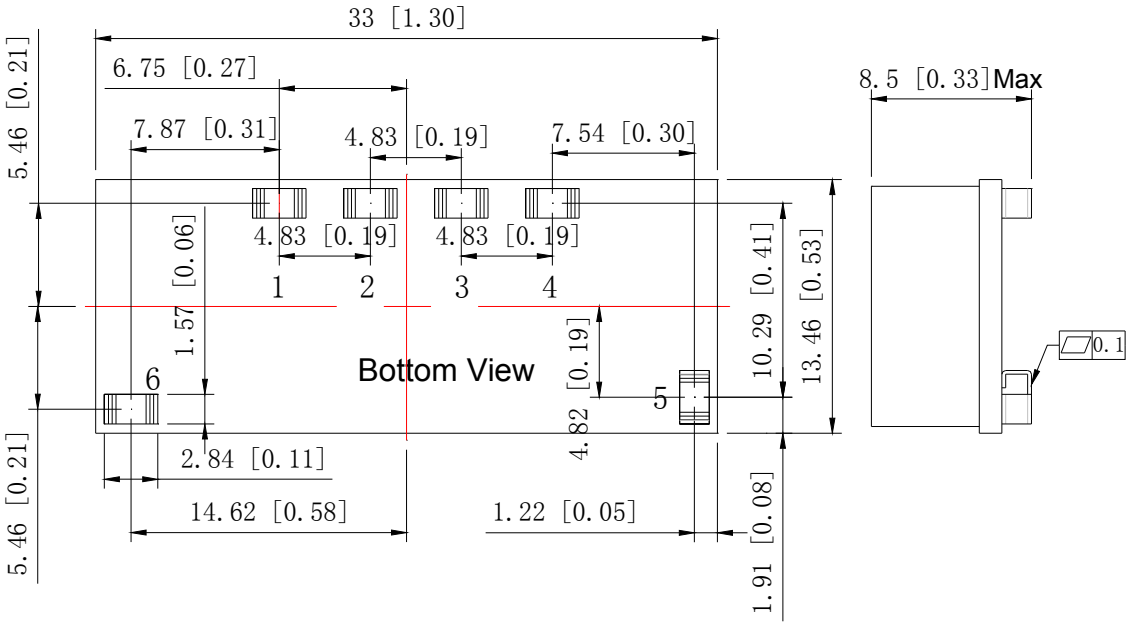


Figure12. Outline Diagram

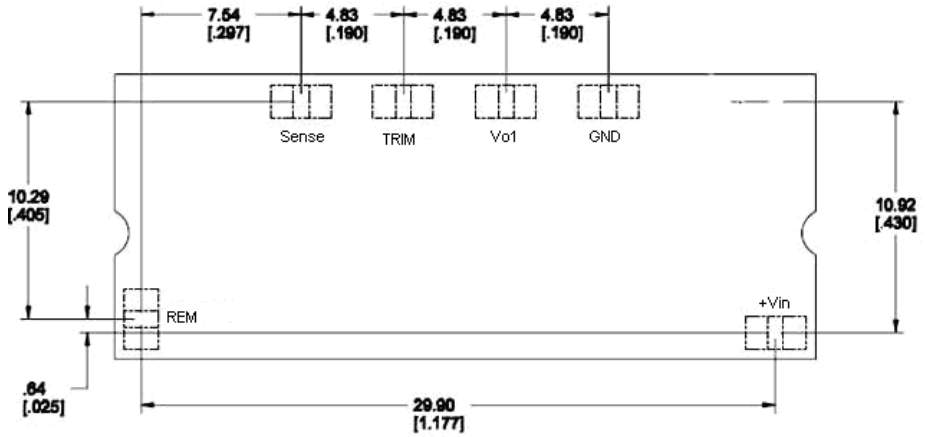


Figure13. Recommended Pad Layout

Note: Dimensions are in mm [inch]. Tolerances: x.x mm ± 0.5mm [x.xx in. ± 0.02 in.],
x.xx mm ± 0.25 mm [x.xxx in. ± 0.010 in.] (Unless otherwise indicated)
Pads Size: 0.140 in. * 0.095 in. (min); 0.165 in. * 0.110 in.(max)

Pin Designation

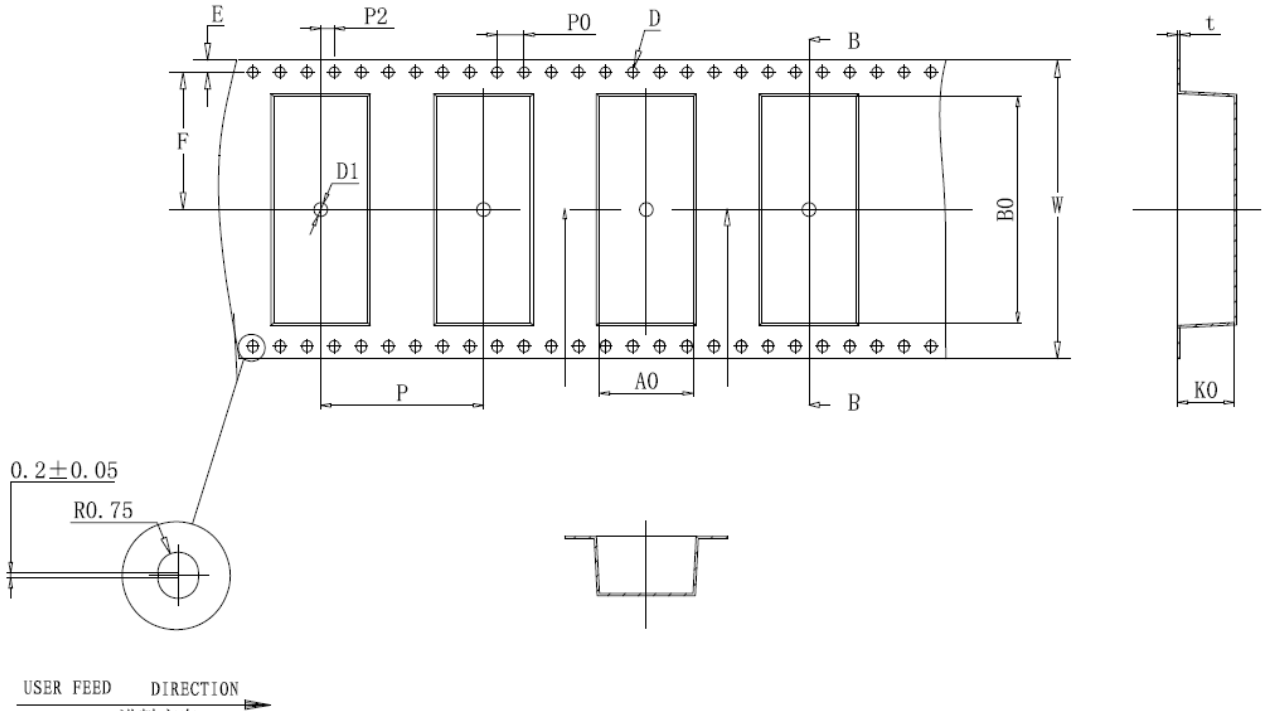
Pins No.	Symbols	Functions
1	GND	Negative input and output
2	Vo1	Positive output
3	TRIM	Adjustable Output voltage
4	Sense	Output voltage compensation
5	REM	Remote control
6	+Vin	Positive input

Packaging Details

The SMT module is supplied in tape & reel as standard. Modules are shipped in quantities of 300 modules per reel.

Tape Dimensions

ITEM	W	A0	B0	K0	P	F	E	D	D1	P0	P2	t	13"	
DIM	44.0	13.7	33.2	7.9	24.0	20.20	1.75	1.50	2.0	4.00	2.00	0.4	Length /tape	Capacity /tape
TOLE	+0.30 -0.30	+0.10 -0.00	+0.10 -0.00	+0.10 -0.00	+0.10 -0.10	+0.10 -0.10	+0.10 -0.10	+0.10 -0.00	+0.10 -0.00	+0.10 -0.10	+0.15 -0.15	+0.05 -0.05	8.0m	300pcs



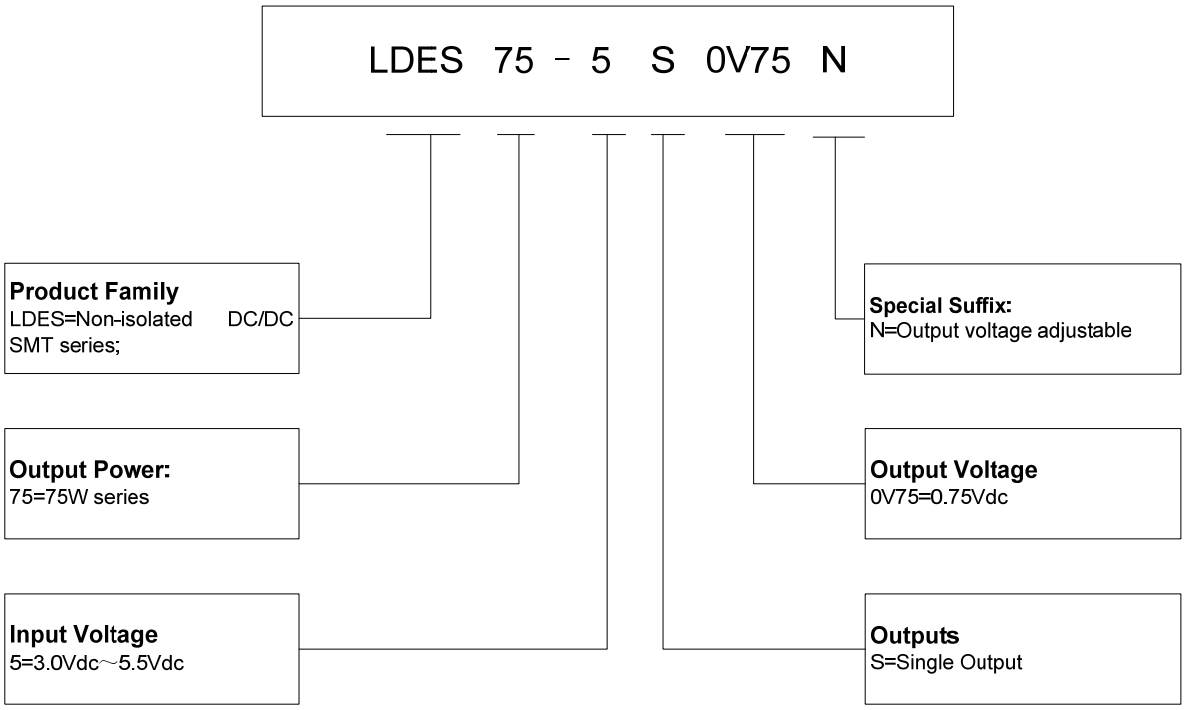
Reel Dimensions

Outside diameter: 330mm (12.99 in.)

Inside diameter: 90 mm (3.54 in.)

Tape Width: 44 mm (1.73 in.)

Naming Rules On Models



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

Add: 1-6/F, No.5 Bldg.,2nd Area, South Zhongguan Honghualing Industrial Park,
Liuxian Road No.1213, Taoyuan Subdistrict, Nanshan, Shenzhen, Guangdong, China
Tel: +86(755)-86000600
Fax: +86(755)-86001330
E-mail: postmaster@suplethic.com
Web: http://www.suplet.com