

NL1 Series

1W Unregulated Single output

Features

- 4 Pin SIL Package
- Continuous Short Circuit Protection
- 3000 VDC Isolation
- Efficiency up to 83%
- -40 ~ 95°C Operation Temperature Range
- Non-Conductive Black Plastic Case



PART NUMBER STRUCTURE

NL1 - **12** **12** **S**
(1) (2) (3) (4)

(1) Series

(2) Input Voltage Range

3R3 - 2.97-3.63 V
05 - 4.5-5.5 V
12 - 10.8-13.2 V
24 - 21.6-26.4 V

(4) Output Type

S - Single Output

(3) Output Voltage Range

3R3 - 3.3 V
05 - 5 V
12 - 12 V
15 - 15 V



ALL SPECIFICATIONS ARE TYPICAL AT 25°C, NOMINAL INPUT AND FULL LOAD UNLESS OTHERWISE NOTED

Model Number	Input Voltage Range (VDC)	Input Current		Output Voltage (VDC)	Output Current Full Load (mA)	Efficiency @FL(%)	Capacitive Load (µF)
		No-Load (mA), max.	Full Load (mA), typ.				
NL1-3R33R3S	2.97-3.63	60	388.5	3.3	303	78	3300
NL1-3R305S	2.97-3.63	65	383.58	5	200	79	2200
NL1-3R312S	2.97-3.63	75	374.11	12	83.33	81	470
NL1-3R315S	2.97-3.63	75	374.11	15	66.67	81	470
NL1-053R3S	4.5-5.5	45	259.74	3.3	303	77	3300
NL1-0505S	4.5-5.5	45	253.16	5	200	79	2200
NL1-0512S	4.5-5.5	55	243.9	12	83.33	82	470
NL1-0515S	4.5-5.5	60	246.91	15	66.67	81	470
NL1-123R3S	10.8-13.2	25	106.83	3.3	303	78	3300
NL1-1205S	10.8-13.2	25	101.62	5	200	82	2200
NL1-1212S	10.8-13.2	25	100.4	12	83.33	83	470
NL1-1215S	10.8-13.2	30	102.88	15	66.67	81	470
NL1-243R3S	21.6-26.4	15	54.11	3.3	303	77	3300
NL1-2405S	21.6-26.4	15	52.74	5	200	79	2200
NL1-2412S	21.6-26.4	15	50.81	12	83.33	82	470
NL1-2415S	21.6-26.4	15	50.2	15	66.67	83	470

PHYSICAL SPECIFICATIONS	
Parameter	Value
Case Material	Nonconductive Black Plastic (UL94V-0 rated)
Pin Material	Copper
Potting Material	Silicone (UL94V-0 rated)
Weight	1.5 g, typ.
Dimensions	0.46" x 0.24" x 0.4"

INPUT SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	3.3 V Input	2.97	3.3	3.63	VDC
	5 V Input	4.5	5	5.5	
	12 V Input	10.8	12	13.2	
	24 V Input	21.6	24	26.4	
Input Current (No Load)		See Table			
Input Current (Full Load)		See Table			
Input Filter		Capacitors			
Input Reflected Ripple Current (1)			20		mApk-pk
Start up Time	Nominal Vin and constant resistive load			10	ms
Recommended input fuse (slow blow)	3.3 V Input	1			A
	05 V Input	0.5			A
	12 V Input	0.25			A
	24 V Input	0.1			A

Note :

1. Measured with a simulated source inductance of 12µH and a source capacitor Cin(47µF, ESR<1.0Ω at 100KHz).

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OUTPUT SPECIFICATIONS						
Parameter	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy	Nominal Vin	-3.0		+3.0	%	
Maximum Output Current		See Table				
Line Regulation	For 1% Vin Change	-1.2		+1.2	%	
Load Regulation	From 10% to 100% Load	3.3 V , 5V Output	-15		+15	%
		Other Output	-10		+10	%
Ripple & Noise	20MHz bandwidth and 0.1µF ceramic capacitor.		150	200	mVpk-pk	
Short Circuit Protection		Continuous and automatic recovery				
Temperature Coefficient		-0.02		+0.02	%/°C	
Capacitive Load	Nominal Vin and constant resistive load	See Table				
Note :						
1. Measured with a 0.1µF ceramic capacitor.						

GENERAL SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Efficiency		See Table			
Isolation Voltage	Input-output, and rated for 60sec	3000			VDC
Isolation Resistance	Input-output	1000			MΩ
Isolation Capacitance	Input-output			65	pF
Switching Frequency			100		kHz
MTBF	MIL-HDBK-217 F @ 25°C		2.1		Mhours
Safety Standard	IEC / EN / UL 62368-1	Designed to meet			
Environmental compliance		RoHS			

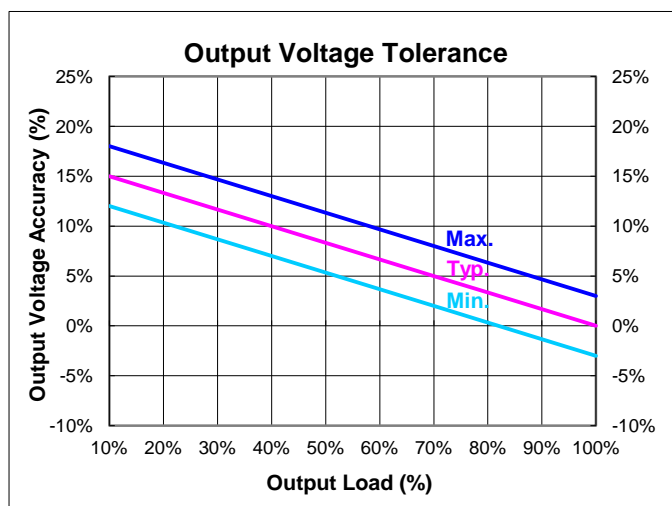
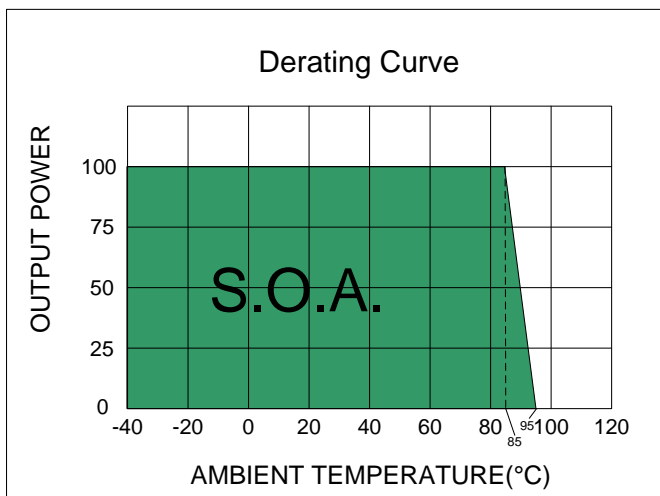
ENVIRONMENT SPECIFICATIONS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating Ambient Temperature	See Power Derating Curve	-40		95	°C
Maximum Case Temperature				115	°C
Thermal Impedance		50			°C/W
Storage Humidity				95	% rel. H
Storage Temperature		-40		125	°C
Cooling	Natural Convection	30-65 LFM			

ABSOLUTE MAXIMUM RATINGS					
Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Surge Voltage (100 ms)	3.3 V Input			6	VDC
	5 V Input			9	
	12 V Input			18	
	24 V Input			30	
Soldering Temperature	1.5mm from case 10sec max.			260	°C
Note : These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.					

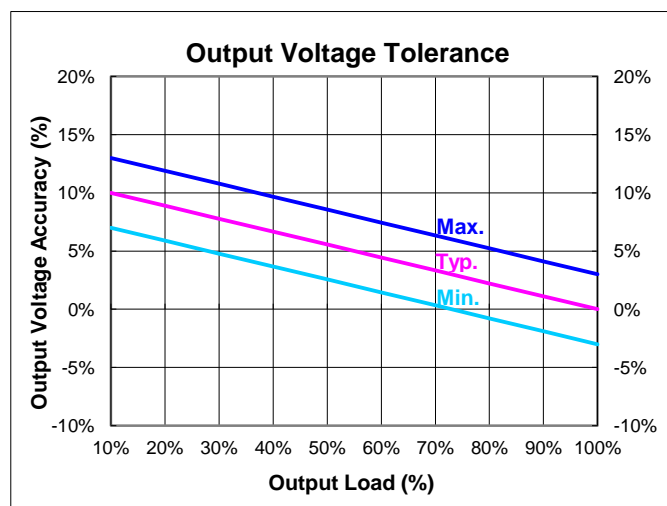
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EMC SPECIFICATIONS			
Parameter	Standard	Condition	Perf. Criteria
Conducted Emissions	EN55032	with external components	B
Radiated Emissions	EN55032		B
ESD	IEC 61000-4-2	Contact $\pm 8kV$, Air $\pm 15kV$	A
RS	IEC 61000-4-3	10V/m	A
EFT	IEC 61000-4-4	$\pm 2.0kV$ with external components	A
Surge	IEC 61000-4-5	$\pm 2.0kV$ with external components	A
CS	IEC 61000-4-6	10Vrms	A
PFMF	IEC 61000-4-8	100A/m	A

ELECTRICAL CHARACTERISTIC CURVES



3.3V and 5V output



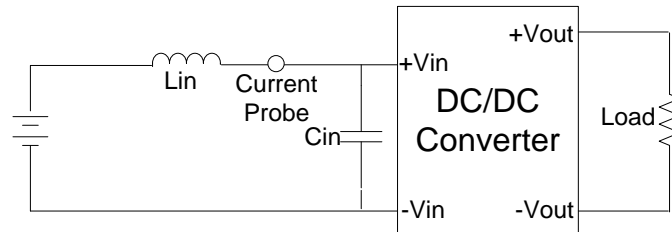
12V and 15V output

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TEST CONFIGURATIONS

Input Reflected Ripple Current Test Step

Input reflected ripple current is measured with a source inductor L_{in} ($12\mu\text{H}$) and a source capacitor C_{in} ($47\mu\text{F}$, $\text{ESR} < 1.0\Omega$ at 100KHz) at nominal input and full load.



DESIGN & FEATURE CONFIGURATIONS

Isolation Voltage

This series is designed to meet the functional insulation of UL, both input and output should be maintained within SELV limits (less than 42.4V peak, or 60VDC).

The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an element of a safety isolation system. The part could be expected to function correctly with hundreds of volts offset applied continuously across the isolation barrier; but then the circuitry on both sides of the barrier must be regarded as operating at an unsafe voltage and further isolation/insulation systems must form a barrier between these circuits and any user-accessible circuitry according to safety standard requirements.

Repeated High-Voltage Isolation Testing

Repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment.

This series has isolation transformers without additional insulation between primary and secondary windings of enameled wire.

While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the wire insulation.

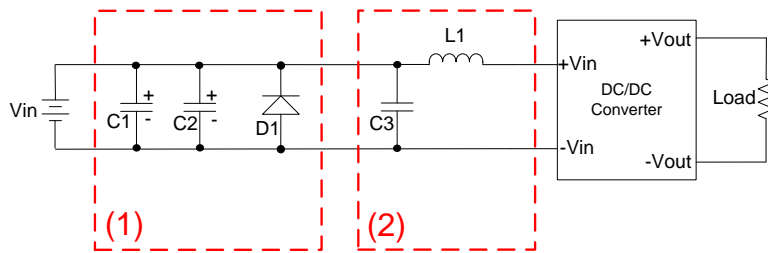
Any material including the enamel (typically polyurethane) is susceptible to eventual chemical degradation when subject to very high applied voltage, thus implying that the number of tests should be strictly limited.

We strongly advise against repeated high voltage isolation testing, but if it is absolutely required, the isolation test voltage should be reduced by 20% from specified test voltage.

DESIGN & FEATURE CONFIGURATIONS

EMC Filter

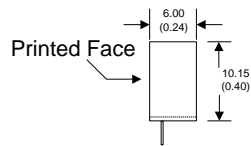
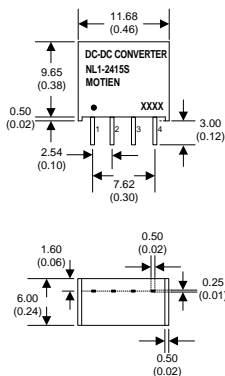
The part (1) Circuit is used to meet Surge & EFT test, and the part (2) Circuit is used to meet EMI test.



Vin	C1	C2	D1	C3	L1
5V	NIPPON Chemi-con KY Series 470uF, 100V	DNP	SMDJ6.0A	MLCC 10uF, 50V	10uH
12V			SMDJ9.0A		
15V			SMDJ18.0A		
24V		NIPPON Chemi-con KY Series 680uF, 100V	SMDJ30.0A		

DESIGN & FEATURE CONFIGURATIONS

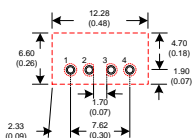
4 Pin SIL Package



- Notes : All dimensions are typical in millimeters (inches).
1. Pin dimension tolerance : ± 0.05 (± 0.002)
 2. Pin pitch and length tolerance: ± 0.35 (± 0.014)
 3. Pin to case tolerance: ± 0.5 (± 0.02)
 4. Case tolerance: ± 0.5 (± 0.02)

PIN CONNECTIONS	
PIN NUMBER	SINGLE
1	-Vin
2	+Vin
3	-Vout
4	+Vout

RECOMMEND FOOTPRINT DETAILS



- Notes : All dimensions are typical in millimeters (inches).
- Pad size(lead free recommended)
1. Through hole 1.2.3.4: $\Phi 0.031$ [0.80]
 2. Top view pad 1.2.3.4: $\Phi 0.039$ [1.10]
pad 2 to pad 3 spacing:0.067[1.70]
 3. Bottom view pad 1.2.3.4: $\Phi 0.063$ [1.60]
pad 2 to pad 3 spacing:0.067[1.70]
 4. The extra protection of the pads between input(PIN 2) and output(PIN 3) should be needed in order to ensure that the isolation function won't be affected after the module mounts on the PCB.