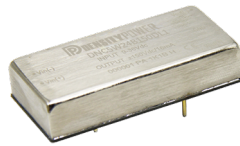


### FEATURES

- 4:1 wide input range: 9-36VDC
- Bipolar output:  $\pm 150$ Volts DC
- Operation temperature range:  
-40°C to +85°C
- 5W isolated output
- Efficiency up to 81%
- Fixed switching frequency
- Six sides shielding
- 2250VDC I/O isolation
- Standard 1.0"×2.0"×0.4" footprint,
- Extensive self-protection, UVLO,  
OTP, OVP, OCP and short protection
- Metal Case, outstanding thermal dissipation
- Fully encapsulated, high reliability
- MTBF  $\geq 1.0$  MHrs
- RoHS compliant



### PRODUCT OVERVIEW

The DNC5W24 series are highly reliable, and efficient isolated DC/DC converter. Wide input range of 9-36V (24V nominal) is ideal for automation, power grid, railway, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

A wealth of self-protection features included input under-voltage lockout, overcurrent protection with "hiccup" autorestart technique, provides short-circuit protection, along with output OVP. The module delivers full output power @ 85°C case temperature.

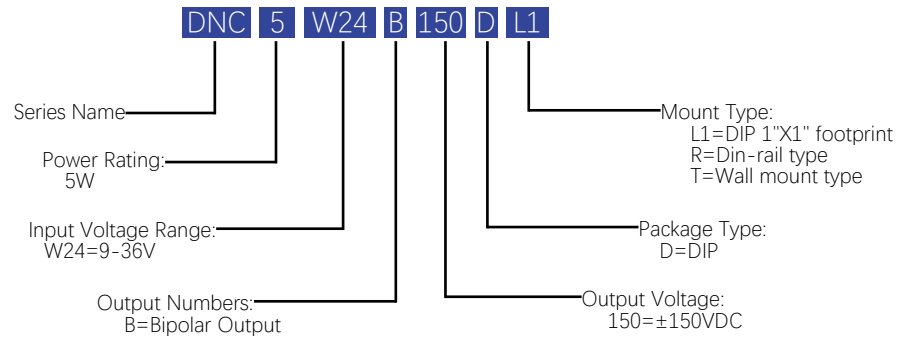
Six sides shielding with advanced fully encapsulated package technology provides outstanding EMC and thermal performance, which is ideal for ruggedized applications involving harsh environments.

The DNC5W24 series are designed to safety standards UL 62368-1.

### Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency Typ. [%]	Capacitive Load Max. [ $\mu$ F]	Package [inch]
DNC5W24B150	24	9-36	$\pm 150$	$\pm 16.6$	81	3.3	2.0"×1.0"×0.4" DIP

### Model Numbering



### Absolute Maximum Ratings

Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous		-0.7		40	VDC
Input Voltage Transient	< 100ms			50	VDC
Operating Case Temperature		-40		105	°C
Operating Environment Temperature		-40		85	°C
Storage Temperature Range		-55		125	°C
Soldering Temperature	Wave soldering < 10s			300	°C
Cooling	Free air convection				

### Safety and EMC Compliance

Conducted Emission	EN55032	Class B (With exter filter)			
Radiated Emission	EN55032	Class B (With exter filter)			
Conducted Susceptibility	IEC6100-4-6	10Vrms Criteria A			
Radiated Susceptibility	IEC6100-4-3	10V/m Criteria A			
EFT	IEC6100-4-4	±2KV Criteria A (With external filter)			
Surge	IEC6100-4-5	±2KV Criteria A (With external filter)			
ESD	IEC6100-4-2	Contact: ±6KV Air: ±8KV Criteria A			
Isolation Safety Rating	Basic insulation				

### Input Specifications

Parameters	Conditions	Min.	Typ.	Max.	Units
Operating Voltage Range		9	24	36	VDC
Start-up Threshold		8.0	8.7	9.0	VDC
Under Voltage Shutdown		7.0	7.8	8.0	VDC
Recommended Input Fuse			2		A

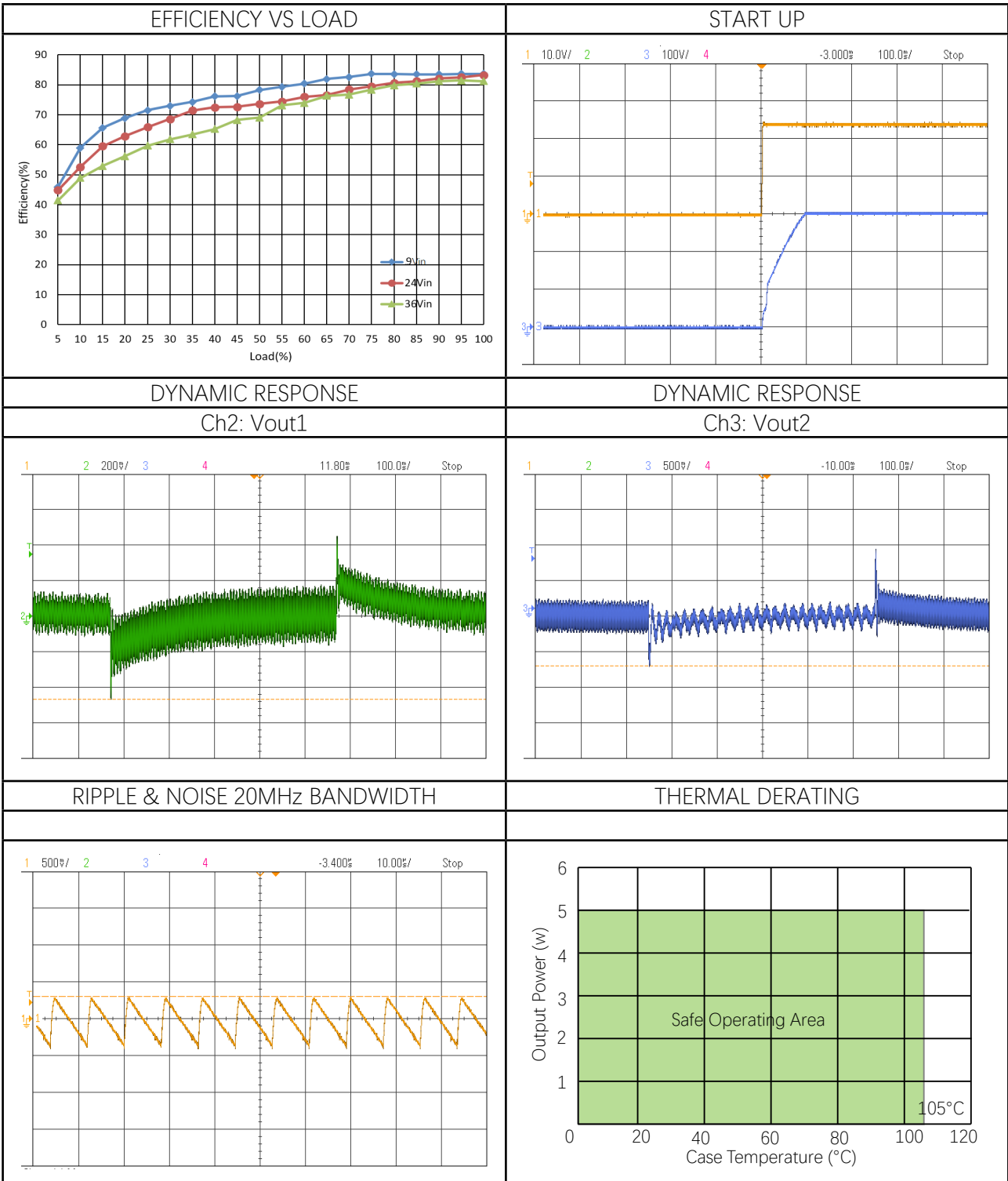
General Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage (Test for 1 minute, 1mA)	Input to output	2250			VDC
	Output to case	1000			VDC
Isolation Resistance (Viso=500VDC)	Input to output	100			MΩ
Isolation Capacitance	Input to output		100		pF
Switching Frequency			121		KHz
Start-up Delay	From undervoltage shutdown recovery to 10% Vout		70		mS
Rise Time	From 10% Vout to 90% Vout capacitive load		70		mS
Vibration	IEC61373:1999 Category I, Class B, Body mounted				
Shock (Operational)	IEC61373:1999 Category I, Class B, Body mounted				

All specifications are tested at 25 °C ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

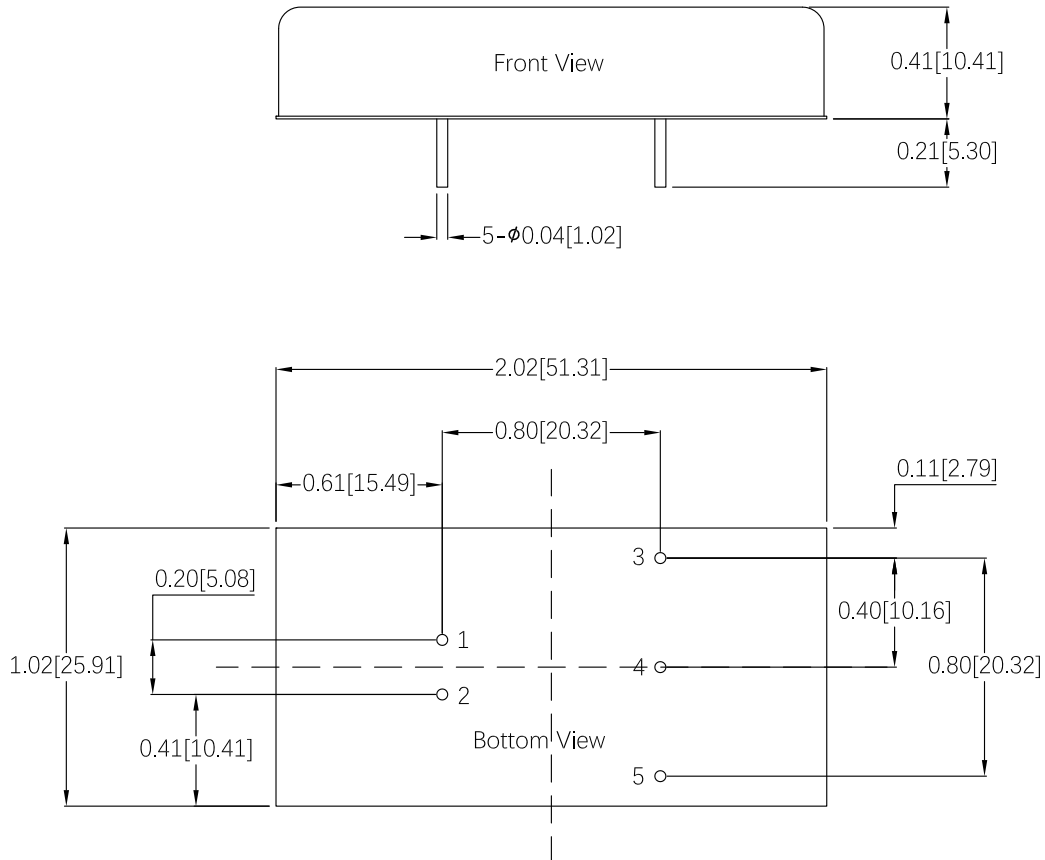
### Performance Data ( $\pm 150$ Vout)

Input Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Reflected Input Ripple Current	Measured at input pin with 12 $\mu$ H inductance and 220 $\mu$ F capacitance used in combination		40		mA pk-pk
Input Current @ No Load			16	62	mA
Input Current @ Min. Line			0.7		A
Recommended External Input Capacitance	1 $\mu$ F CBB and 100 $\mu$ F E-cap used in combination		22		$\mu$ F
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint	50% Load, Vin=24V	148.5	150.0	151.5	VDC
Vout Accuracy		-1.0		+1.0	%
Line Regulation		-0.2		+0.2	%
Load Regulation		-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	% of Vout / $^{\circ}$ C
Over Current Protection	Hiccup, auto-recover		200		%
Over Voltage protection	Hiccup, auto-recover	105		115	%
Output Short Protection	Hiccup, auto-recover				
Ripple & Noise Max. <sup>①</sup>			0.7		V Pk-Pk
Dynamic Load Peak Deviation <sup>②</sup>		-5		+5	%Vout
Dynamic Load Response				250	$\mu$ S
Minimum Load	No minimum load required				
Notes					
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 7 for more details.					
② For single output types, load is set from 50%-75%-50% of full load, di/dt=1A/ $\mu$ S.					

Performance Data ( $\pm 150$  Vout)



### Mechanical Specifications



**PIN:**

Pin1, PIN2, PIN3, PIN4, PIN5:  $\Phi 0.040$

Material: Copper alloy

Finish: Tin 3 ~ 5 $\mu\text{m}$ (min.) over nickel 50 $\mu\text{m}$ (Min.)

**Tolerance:**

X.XX =  $\pm 0.02$  (0.5)

X.XXX =  $\pm 0.010$  (0.25)

Dimensions are in inches [mm]

Weight: ~30g.

PIN CONNECTIONS	
Pin	Function
1	+Vi
2*	-Vi
3	+Vo
4	Com
5	-Vo

Pin	Function
1	+Vi
2*	-Vi
3	+Vo
4	Com
5	-Vo

\*Note: The case is connected to -Vi.

### Technical Notes

#### INPUT FUSING

Certain applications may require fuse at the inputs of power conversion components. Fuses should also be used when there is possibility of sustained input voltage reversal which is not current limited. The DNC5W24 modules are not internally fused. We strongly recommend a slow-blown fuse to be used in the ungrounded input supply line. For safety agency approvals, the installer must install the converter in compliance with the end user safety standard.

#### TYPICAL APPLICATION CONNECTION

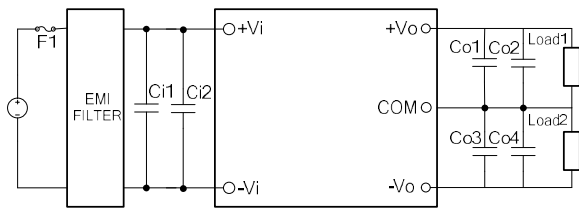


Figure 1: Typical Application Connection

In order to prevent the input line from causing the input oscillation, it is recommended to add the input capacitor close to the input of the module. Similarly, the output capacitor is added to the output of the module. Specific recommended parameters: input capacitance  $C_{i1}=47\sim 100\mu\text{F}$  electrolytic capacitor,  $C_{i2}=1\mu\text{F}$  CBB capacitor. For output Capacitance,  $C_{o1}$ ,  $C_{o2}$ ,  $C_{o3}$ ,  $C_{o4}$  ESR < 0.1Ω.

#### REFLECTED RIPPLE CURRENT

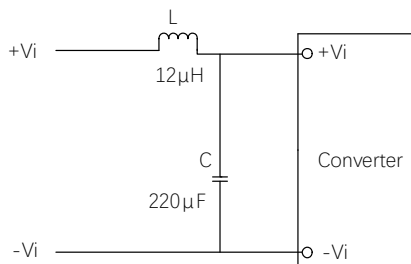


Figure 2: Reflected Ripple Current

Add LC filter at the front of the power module to

reduce the interference of reflected ripple current on the DC bus, recommended value of L and C with appropriate current and voltage rating as below:  $L=12\mu\text{H}$ ;  $C=220\mu\text{F}$ .

#### OUTPUT RIPPLE & NOISE

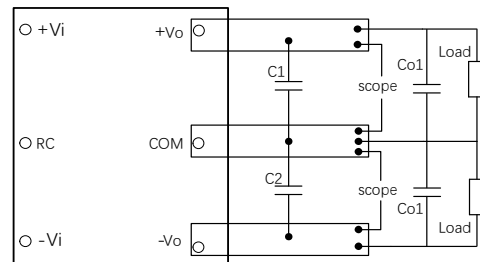


Figure 3: Output Ripple & Noise

These DNC5W24 modules' output ripple and noise is measured at the rated input voltage and output current, along with 0.1μF MLCC with appropriate voltage ratings and placed as  $C_1$  &  $C_2$  shown in the figure above. The scope's bandwidth is set to 20MHz.

External output capacitors are required to reduce the ripple & noise. The output capacitors should be low ESR and appropriate frequency response with appropriate voltage ratings, and must be located as close to the converters as possible, also PCB layout must be taken into consideration.

#### INPUT UNDERVOLTAGE SHUTDOWN AND START-UP THRESHOLD

Once operating, module will not turn off until the input voltage drops below the Undervoltage Shutdown threshold. Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.

#### CURRENT LIMITING

The output voltage remains constant as the output current increases. However, once the output current is over the specified Output DC Current Limit, the converter turns off.

### Technical Notes

The converter then enters a "hiccup mode" where it repeatedly turns on and off until the short circuit condition is removed. This prevents excessive heating of the converter or the load board.

#### SHORT CIRCUIT CONDITION

When the converter is in current-limit mode, the output voltage will drop as the output current demand increases and then the converter will be shut down. If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The module is capable of enduring an indefinite short circuit output condition.

#### OUTPUT OVERVOLTAGE PROTECTION

DNC5W24 output voltages are monitored for an overvoltage condition via magnetic feedback. The signal is coupled to the primary side and if the output voltage rises to a level which could be damaging to the load, the sensing circuitry will power down the PWM controller causing the output voltages to decrease. Following a time-out period the PWM will restart, causing the output voltages to ramp to their appropriate values. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle.

#### THERMAL SHUTDOWN

The DNC5W24 converters are equipped with thermal shutdown circuitry. If environmental conditions cause the internal temperature of the converter to rise above the designed temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will auto restart.



This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:

Refer to: <http://www.densitypower.com>

Density Power makes no representation that the use of its products in the circuits described herein, or the use of other technical information contained herein, will not infringe upon existing or future patent rights. The descriptions contained herein do not imply the granting of licenses to make, use, or sell equipment constructed in accordance therewith.

Specifications are subject to change without prior notice.