Murata Power Solutions

NDH Series

Isolated 3W Dual Output DC-DC Converters

FEATURES

- RoHS compliant
- Compact SIP form factor
- 2:1 Wide range voltage input
- Continuous short circuit protection with current foldback
- Operating temperature range –40°C to +85°C
- 0.5% load regulation
- 1kVDC isolation
- 24V & 48V nominal inputs
- 12V & 15V outputs
- Power density 1.00W/cm^3
- Remote on/off
- No electrolytic capacitors
- Low noise

PRODUCT OVERVIEW

The NDH series is a range of high performance miniature DC-DC converters having regulated outputs over the wide temperature range of –40°C to +85°C. The input voltage range is 2:1 and the input to output isolation is 1kVDC. Continuous short circuit protection, external control and extremely small SIP packaging provide state of the art functionality. The use of ceramic capacitors and a ceramic substrate, and SMD construction, provide genuine high reliability. Nominal input voltages of 24 and 48V with output voltages of 12 and 15V are available as standard with custom parts on request. The plastic case is rated to UL 94V-0 with encapsulant to UL 94V-1.

RoHS COMPLIANT

For full details go to www.murata-ps.com/rohs

SELECTION GUIDE

Order Code	Input Voltage	Rated Output Voltage	Output Current		Input Current[2]	Efficiency (MIN.)	Isolation Capacitance	Recommended Alternative
			Min Load[3]	Full Load				
	V (NOM.)	V	mA	mA	mA	%	pF	
To be discontinued								
NDH2412SC	24	±12	±32	125	157	81	36	Contact Murata
NDH2415SC	24	±15	±25	100	155	82	36	Contact Murata
Discontinued								
NDH4812SC	48	±12	±32	125	78	78	40	Contact Murata
NDH4815SC	48	±15	±25	100	78	78	40	Contact Murata

INPUT CHARACTERISTICS

Parameter	Conditions	MIN.	TYP.	MAX.	Units
Voltage range	All NDH24 types	18	24	36	V
	All NDH48 types	36	48	72	
Reflected ripple current	All NDH24 types when 10µF at input		200	250	mA p-p
	All NDH48 types when 10µF at input		105	150	
Shutdown Power	V_{IN} Nominal 24XX		8		mW
	V_{IN} Nominal 48XX		16		

OUTPUT CHARACTERISTICS

Parameter	Conditions	MIN.	TYP.	MAX.	Units
Voltage set point accuracy	With external input/output capacitors		±1	±5	%
Line regulation	Low line to high line with external input/output capacitors		0.05	0.2	%
Load regulation	Minimum load to rated load with external input/output capacitors		0.2	0.5	%
Ripple	BW = 20Hz to 300kHz with external input/output capacitors		15	30	mV rms
Ripple & noise	BW = DC to 20MHz with external input/output capacitors		90	150	mV p-p
Cross regulation	% voltage change on negative output when positive load varies from 12% to 50% with negative load fixed at 50%		2.1	5.0	%

ISOLATION CHARACTERISTICS

Parameter	Conditions	MIN.	TYP.	MAX.	Units
Isolation test voltage	Flash tested for 1 second	1000			V_{DC}
Resistance	V_{ISO} = 1000V_{DC}	1			GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	MIN.	TYP.	MAX.	Units
Control pin (CTRL) input current	Please refer to control pin application note	6		15	mA
Switching frequency	Load causing lowest frequencies, 100% load V_{IN} MIN.	100	125	150	kHz
	Load causing highest frequencies, 25% load V_{IN} MAX.	300	400	500	

1. Absolute maximum value for 30 seconds. Prolonged operation may damage the product.
2. Measured at full load with external input/output capacitors. Refer to application note.
3. A lower load condition can be used but higher levels of output ripple may be experienced, this condition may also cause the output voltage to exceed its specification transiently during power down when the input voltage also falls below its rated minimum.

All specifications typical at T_A=25°C, Nominal input voltage and rated output current unless otherwise specified.

TEMPERATURE CHARACTERISTICS					
Parameter	Conditions	MIN.	TYP.	MAX.	Units
Specification		-40		85	°C
Operation		-40		100	
Storage		-50		130	
Case temperature rise above ambient	12V & 15V output types @ 100% load			36	

ABSOLUTE MAXIMUM RATINGS	
Short-circuit protection	Continuous
Lead temperature 1.5mm from case for 10 seconds	260°C
Wave Solder	Wave Solder profile not to exceed the profile recommended in IEC 61760-1 Section 6.1.3. Please refer to application notes for further information.
Minimum output load for specification[3]	25% of rated output
Control pin input current	15mA
Input voltage 24 types[1]	40V
Input voltage 48 types[1]	80V
Free air space	10mm MIN. around component

MTTF (MEAN TIME TO FAILURE)			
Part Number	MTTF	Units	Conditions
NDH2412SC	2077	kHrs	Calculated using MIL-HDBK 217F with Nominal input at full voltage (ground benign) at 25°C.
NDH2415SC	2080		
NDH4812SC	2090		
NDH4815SC	2045		

TECHNICAL NOTES

ISOLATION VOLTAGE

'Hi Pot Test', 'Flash Tested', 'Withstand Voltage', 'Proof Voltage', 'Dielectric Withstand Voltage' & 'Isolation Test Voltage' are all terms that relate to the same thing, a test voltage, applied for a specified time, across a component designed to provide electrical isolation, to verify the integrity of that isolation.

Murata Power Solutions NDH series of DC-DC converters are all 100% production tested at their stated isolation voltage. This is 1kVDC for 1 second.

A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?"

For a part holding no specific agency approvals, such as the NDH series, both input and output should normally be maintained within SELV limits i.e. 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 several hundred 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

It is well known that 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. The NDH series has an EI ferrite core, with no additional insulation between primary and secondary windings of enamelled 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 this enamel (typically polyurethane) is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage.

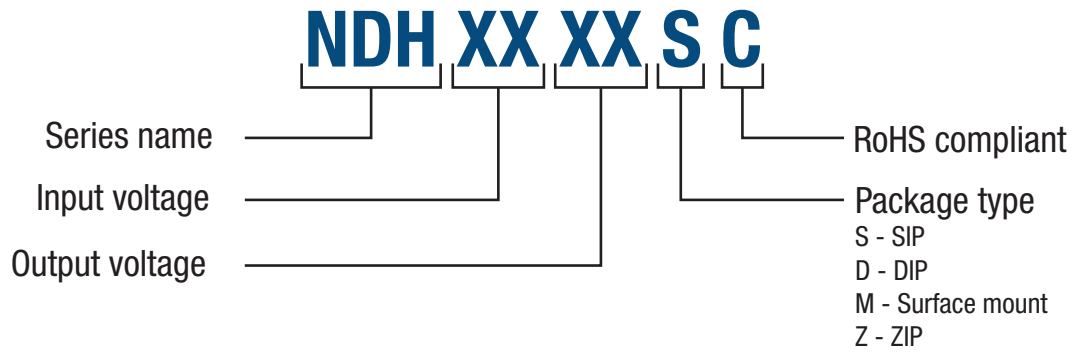
This consideration equally applies to agency recognised parts rated for better than functional isolation where the wire enamel insulation is always supplemented by a further insulation system of physical spacing or barriers.

RoHS COMPLIANCE INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260ºC for 10 seconds. Please refer to application notes for further information. The pin termination finish on this product series is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems.
For further information, please visit www.murata-ps.com/rohs

PART NUMBER STRUCTURE



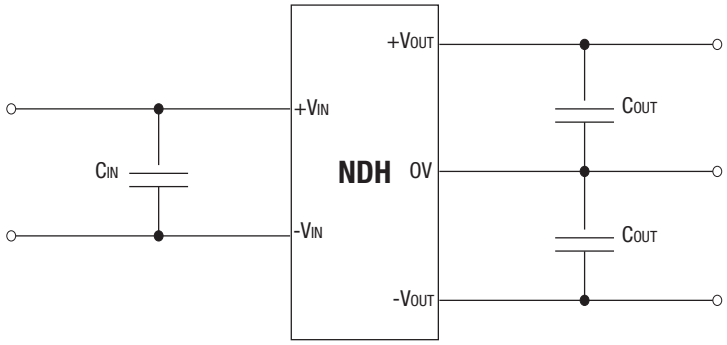
APPLICATION NOTES

External capacitance

Although these converters will work without external capacitors, they are necessary in order to guarantee the full parametric performance over the full line and load range. All parts have been tested and characterised using the following values and test circuit.

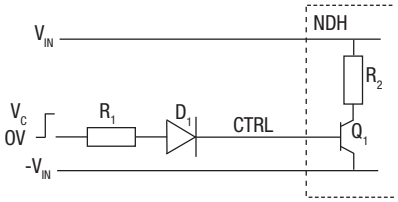
Value	
C_{IN}	C_{OUT}
10µF, 200V	47µF, 25V

Test circuit



Control Pin

The NDH converters have a shutdown feature which enables the user to put the converter into a low power state. The control pin connects directly to the base of an internal transistor, and the switch off mechanism for the NDH works by forward biasing this NPN transistor. If the pin is left open (high impedance), the converter will be ON (there is no allowed low state for this pin), but once a control voltage is applied with sufficient drive current, the converter will be switched OFF. A suitable application circuit is shown below.



D_1 (eg 1N4001) is required to provide high impedence when the signal is low. From the NDH specification, the drive current to operate this function is recommended to be 6mA, and hence the value of R_1 can be derived as follows:

$$R_1 = \frac{V_C - V_D - V_Q}{I_C}$$

Assuming V_C=5V, V_D=0.7V and V_Q=1V:

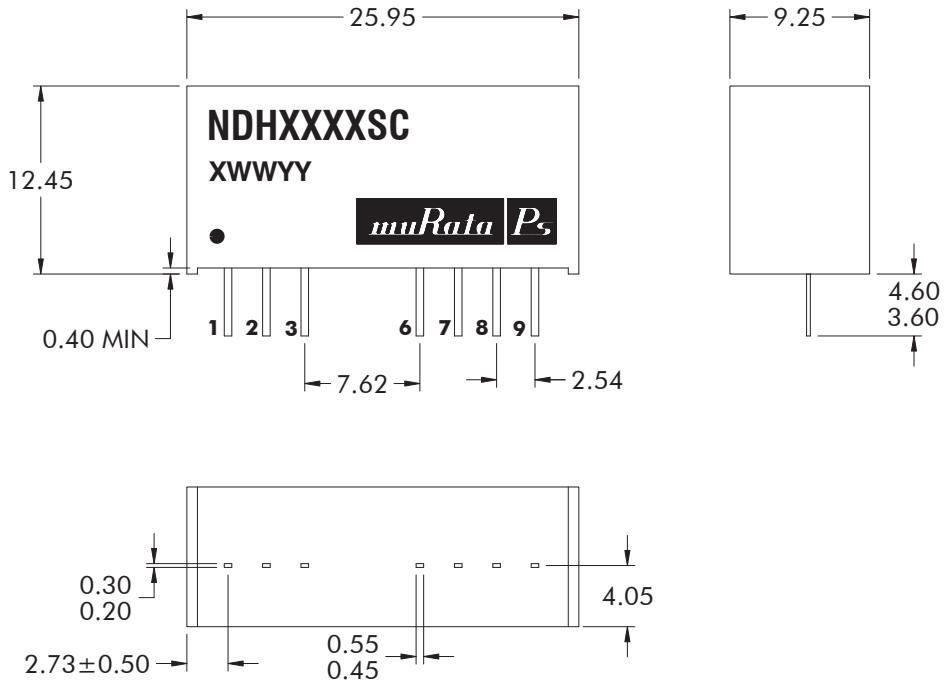
$$R_1 = \frac{5 - 0.7 - 1.0}{6 \times 10^{-3}} = 550\Omega$$

Cross Regulation

Load regulation is at its best when the positive and negative loads are balanced. When the loads are asymmetric, the negative output is not as tightly regulated as the positive output. To meet ripple specification a total minimum load of 25% full load is required, however, the NDH can be used with much lighter loading at the expense of increased ripple. A small load is required on the negative output of 150mW to ensure the maximum negative output voltage is not exceeded.
Cross regulation is defined as change in the negative output voltage as a percentage of nominal as the positive output load is changed from 12.5% to 50% with the negative load is fixed at 50% of full load.

PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



PIN CONNECTIONS

Pin	Function
1	$-V_{IN}$
2	$+V_{IN}$
3	CTRL
6	$+V_{OUT}$
7	0V
8	N/A
9	$-V_{OUT}$

Package weight: 6.5g

N/A - Not available for electrical connection

All pins on a 2.54 (0.1) pitch and within ± 0.25 (0.01) of true position.

Unless otherwise stated all dimensions in inches(mm) ± 0.25(0.01).

DISCLAIMER

Unless otherwise stated in the datasheet, all products are designed for standard commercial and industrial applications and NOT for safety-critical and/or life-critical applications.

Particularly for safety-critical and/or life-critical applications, i.e. applications that may directly endanger or cause the loss of life, inflict bodily harm and/or loss or severe damage to equipment/property, and severely harm the environment, a prior explicit written approval from Murata is strictly required. Any use of Murata standard products for any safety-critical, life-critical or any related applications without any prior explicit written approval from Murata shall be deemed unauthorised use.

These applications include but are not limited to:

- Aircraft equipment
- Aerospace equipment
- Undersea equipment
- Power plant control equipment
- Medical equipment
- Transportation equipment (automobiles, trains, ships, etc.)
- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Data Processing equipment

Murata makes no express or implied warranty, representation, or guarantee of suitability, fitness for any particular use/purpose and/or compatibility with any application or device of the buyer, nor does Murata assume any liability whatsoever arising out of unauthorised use of any Murata product for the application of the buyer. The suitability, fitness for any particular use/purpose and/or compatibility of Murata product with any application or device of the buyer remain to be the responsibility and liability of the buyer.

Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards that anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm, and take appropriate remedial actions. Buyer will fully indemnify and hold Murata, its affiliated companies, and its representatives harmless against any damages arising out of unauthorised use of any Murata products in any safety-critical and/or life-critical applications.

Remark: Murata in this section refers to Murata Manufacturing Company and its affiliated companies worldwide including, but not limited to, Murata Power Solutions.