Murata Power Solutions

NDX Series

Isolated 7.5W Wide Input Dual Output DC/DC Converters

FEATURES

- RoHS compliant
- 2:1 Wide range voltage input
- Continuous short circuit protection with current foldback
- Operating temperature range –40°C to 85°C
- 0.2% Typical load regulation
- 1kVDC Isolation
- Efficiency from 67%
- 5V, 12V, 24V & 48V Nominal input
- ±5V, ±12V & ±15V Dual outputs
- Power density 0.94W/cm^3
- Optional remote On/Off
- UL 94V-0 Package materials
- No electrolytic capacitors
- Low noise
- Custom solutions available

PRODUCT OVERVIEW

The NDX series of DC/DC converters provide up to 7.5W of output power with dual outputs. Unbalanced loading capability with an optional input control pin which will shutdown the NDX from TTL levels. Input voltages of 5V (4.5V to 9V), 12V (9V to 18V), 24V (18V to 36V), and 48V (36V to 75V) with outputs of ±5V, ±12V or ±15V provided. The device is housed in a 5 sided metal case potted with UL 94V-0 rated material. The pinout is an industry standard 5 pin arrangement with an additional optional control pin.

RoHS COMPLIANT 2002/95/EC

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

SELECTION GUIDE

Order Code[1]	Input Voltage	Output Voltage	Output Current[2] ±12.5% Load	Output Current[2] ±50% Load	Input Current 0% Load	Input Current 100% Load	Input Current Shut Down	Efficiency (Min.)	Isolation Capacitance
	V (Nom.)	V	mA	mA	mA	A	mA	%	pF
NDXD0505C	5	±5	±150	±600	19.4	1.83		67	40
NDXD0505EC	5	±5	±150	±600	19.4	1.83	0.075	67	40
NDXD0512C	5	±12	±78.1	±312	33.4	2.15		69	42
NDXD0512EC	5	±12	±78.1	±312	33.4	2.15	0.075	69	42
NDXD0515C	5	±15	±62.5	±250	41.8	2.69		71	43
NDXD0515EC	5	±15	±62.5	±250	41.8	2.69	0.075	71	43
NDXD1205C	12	±5	±187	±750	13.2	0.89		73	36
NDXD1205EC	12	±5	±187	±750	13.2	0.89	0.176	73	36
NDXD1212C	12	±12	±78.1	±312	15	0.86		78	41
NDXD1212EC	12	±12	±78.1	±312	15	0.86	0.159	78	41
NDXD1215C	12	±15	±62.5	±250	17	0.86		79	41
NDXD1215EC	12	±15	±62.5	±250	17	0.86	0.175	79	41
NDXD2405C	24	±5	±187	±750	4.2	0.402		75	58
NDXD2405EC	24	±5	±187	±750	4.2	0.402	0.15	75	58
NDXD2412C	24	±12	±78.1	±312	6.3	0.380		81	56
NDXD2412EC	24	±12	±78.1	±312	6.3	0.380	0.4	81	56
NDXD2415C	24	±15	±62.5	±250	7.0	0.380		82	56
NDXD2415EC	24	±15	±62.5	±250	7.0	0. 380	0.4	82	56
NDXD4805C	48	±5	±187	±750	3.6	0.198		77	61
NDXD4805EC	48	±5	±187	±750	3.6	0.198	0.08	77	61
NDXD4812C	48	±12	±78.1	±312	5.9	0.190		82	57
NDXD4812EC	48	±12	±78.1	±312	5.9	0.190	0.5	82	57
NDXD4815C	48	±15	±62.5	±250	5.9	0.190		82	58
NDXD4815EC	48	±15	±62.5	±250	5.9	0.190	0.5	82	58

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	5V input types	4.5	5	9	V
	12V input types	9	12	18	
	24V input types	18	24	36	
	48V input types	36	48	75	
Reflected ripple current	5V input types with 100µF at input		70		mA p-p
	12V input types with 100µF at input		18		
	24V input types with 10µF at input		90		
	48V input types with 10µF at input		80		

ABSOLUTE MAXIMUM RATINGS

Short-circuit protection (Max. case temperature rise 95°C above ambient)	12V, 15V outputs	Continuous
	5V output, VIN = nominal, 25ºC	Continuous
Lead temperature 1.0mm from case for 10 seconds (to JEDEC JESD22-B106 ISS C)		260°C
Minimum output load for specification[2]		12.5% of rated load on each output
Control pin input voltage		7V
Input voltage, NDXD05 types		10V
Input voltage, NDXD12 types		20V
Input voltage, NDXD24 types		40V
Input voltage, NDXD48 types		80V

1. Suffix 'EC' indicates optional CTRL pin is fitted, as indicated in the mechanical dimensions section.
2. Please refer to minimum load application notes section on page 3.

All specifications typical at T_A=25°C, with recommended input/output capacitors (refer to application note), nominal input voltage and rated output current unless otherwise specified.

OUTPUT CHARACTERISTICS

Parameter	Conditions			Min.	Typ.	Max.	Units
Rated power						7.5	W
Voltage set point accuracy	With external input/output capacitors		5V & 12V Input		±3	±5	%
			24V & 48V Input		±2	±5	
Line regulation	Low line to high line, with external input/output capacitors		5V & 12V Input		0.1	0.9	%
			24V & 48V Input		0.04	0.4	
Load regulation	25% total load to 100% total load With external input/output capacitors	5V & 12V input			0.2	0.9	%
		24V & 48V input			0.2	0.75	
Ripple[2]	BW=20Hz to 300kHz, with external input/output capacitors				5.0	10	mVrms
Noise[2]	BW=DC to 20MHz With external input/output capacitors				32	50	mVp-p
Cross regulation	% voltage change on negative output when positive load varies from 25% to 75% with negative load fixed at 100%	5V & 12V input	5V output		3.8	6	%
			12V, 15V output		1.5	5	
		24V & 48V input	5V output		2.5	7	
			12V, 15V output		2.5	5	

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation test voltage	Flash tested for 1 second	1000			VDC
Resistance	Viso = 1kVDC	1			GΩ

GENERAL CHARACTERISTICS[1]

Parameter	Conditions			Min.	Typ.	Max.	Units
Switching frequency	100% total load to 25% total load	5V & 12V input	5V outputs	100		900	kHz
			12V & 15V outputs				
		24V & 48V input	5V outputs	100		680	
			12V & 15V outputs			620	
Control pin input voltage	Module ON (or pin unconnected)			-0.6		0.8	V
				-0.1		0.2	mA
	Module OFF			3.0		7.0	V
				0.3		3.0	mA

TEMPERATURE CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Operation			-40		85	°C
Storage			-50		130	
Case temperature rise above ambient	100% Load, Nom V_{IN}, Still Air	1212, 1215, 2412, 2415, 4812, 4815		35		
		0512, 1205, 2405, 4805		43		
		0505, 0515, 1205		48		

MEAN TIME TO FAILURE (MTTF)[1]

Part Number	0°C	25°C	Units
NDXD2412C	2590	1528	kHrs
NDXD2415C	2492	1462	
NDXD4812C	2587	1558	
NDXD4815C	2351	1379	

1. Calculated using MIL-HDBK-217F with nominal input voltage at full load.
2. See Ripple & Noise characterisation method.

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

RoHS COMPLIANCE INFORMATION

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260ºC for 10 seconds. The pin termination finish on this product series is a Gold flash (0.05-0.10 micron) over Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems. For further information, please visit www.murata-ps.com/rohs

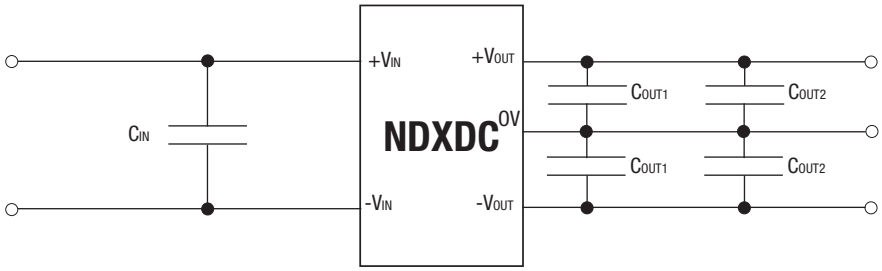
APPLICATION NOTES

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		
Input Voltage	C_{IN}	C_{OUT1}	C_{OUT2}
5V & 12V input	100µF, 100V	0.1µF, 25V multi-layer ceramic	100µF, 25V (low ESR)
24V & 48V input	10µF, 200V		

Recommended Input & Output Capacitors



Control Pin

This provides an OFF function, which puts the converter into a low power mode. When the pin is high the converter is OFF. Standard TTL levels can be used but the maximum high level must not exceed 7.0V. The pin can be left open for normal operation or at voltage below 0.8V with respect to the $-V_{IN}$ pin.

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 NDX can be used with much lighter loading at the expense of increased ripple. A small load of 150mW is required on the negative output to ensure the maximum negative output voltage is not exceeded. NDX cross regulation is defined on page 2.

Minimum load

The minimum load for correct operation is 25% of the full rated load across the specified input voltage range. Lower loads may cause a significant increase in output ripple and may cause the output voltage to exceed its specification transiently during power-down when the input voltage also falls below its rated minimum. A minimum loading of 30% load is required on NDXD4805 to prevent output voltage rise above specification during power-down.

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 NDX 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 NDX 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 NDX series has an EI ferrite core, with no 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 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 recognized 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.

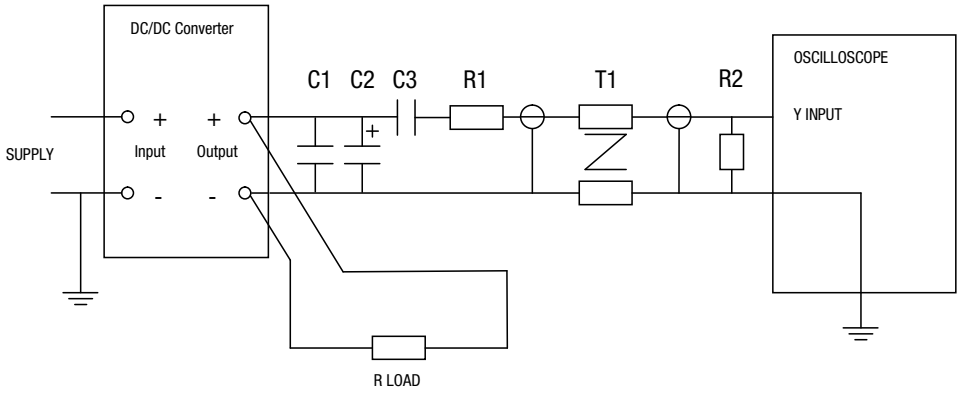
CHARACTERISATION TEST METHODS

Ripple & Noise Characterisation Method

Ripple and noise measurements are performed with the following test configuration with the inclusion of recommended input and output capacitors.

C1	1uF X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter
C2	10uF tantalum capacitor, voltage rating to be a minimum of 1.5 times the output voltage of the DC/DC converter with an ESR of less than 100mΩ at 100 kHz
C3	100nF multilayer ceramic capacitor, general purpose
R1	450Ω resistor, carbon film, +/-1% tolerance
R2	50Ω BNC termination
T1	3T of the coax cable through a ferrite toroid
RLOAD	Resistive load to the maximum power rating of the DC/DC converter. Connections should be made via twisted wires
R3	50Ω resistor, carbon film, +/-1%
Measured values are multiplied by 10 to obtain the specified values.	

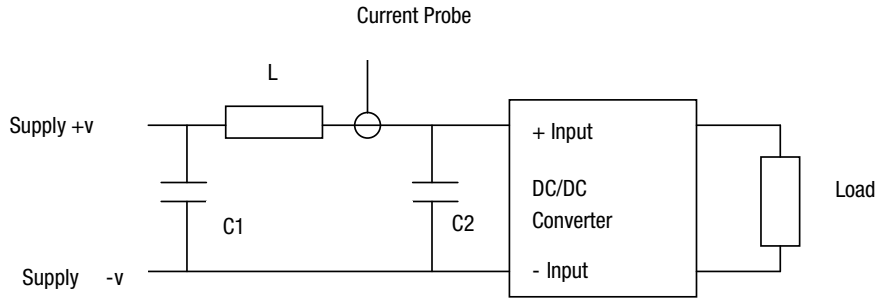
Differential Mode Noise Test Schematic



Input Reflected Ripple Current Test Method

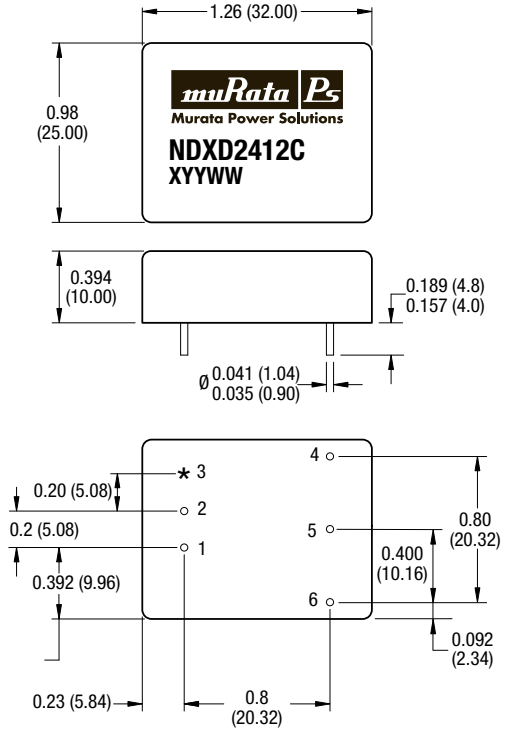
Input reflected ripple current measurements are performed with the following test configuration with the inclusion of recommended input and output capacitors.

C1	220uF with ESR of <0.1Ω at 100kHz, rated at supply voltage
L1	12uH rated at 150% minimum of the DC current taken by the converter.
C2	The recommended input capacitor for the DC/DC converter.



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



* Optional pin
All dimensions in inches ±0.010 (mm 0.25mm).
All pins on a 0.100 (2.54) pitch and within 0.010 (0.25) of true position.

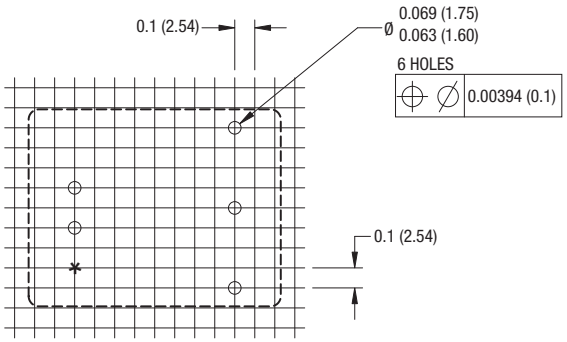
Weight: 20g

PIN CONNECTIONS

Pin	Function
1	$-V_{IN}$
2	$+V_{IN}$
3*	CTRL
4	$+V_{OUT}$
5	0V
6	$-V_{OUT}$

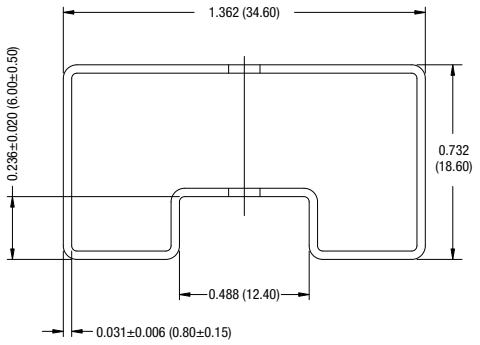
* Optional pin

RECOMMENDED FOOTPRINT DETAILS



All dimensions in inches ±0.010 (mm 0.25mm).

TUBE OUTLINE DIMENSIONS



All dimensions in inches ±0.010 (mm 0.25mm).

Quantity: 15

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