NDX Series





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 outputs
- Power density 0.94W/cm³
- 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 single or dual outputs. Unbalanced loading capability with an optional input control pin. 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.





Isolated 7.5W Wide Input Single & Dual Output DC/DC Converters

SELECTION G	JIDE										
Order Code ¹	Nominal Input Voltage	Output Voltage	Output Current at 25% Load ²	Output Current at 100% Load ²	Input Current at 0% Load	Input Current at 100% Load	Input Current at shutdown	Ripple &Noise ³ (Typ.)	Ripple &Noise ³ (Max.)	Efficiency (Min.)	Isolation Capacitance
		V		mA	mA	A	mA		р-р	%	рF
NDXS0512C	5	12	156	625	42	2.02		79	110	68	55
NDXS0512EC	5	12	156	625	42	2.02	0.48	79	110	68	55
NDXS0515C	5	15	125	500	46.2	2.02		55	80	67	49
NDXS0515EC	5	15	125	500	46.2	2.02	0.46	55	80	67	49
NDXS1212C	12	12	156	625	19.4	0.77	0.51	31	50	77	56
NDXS1212EC	12	12	156	625	19.4	0.77	0.51	31	50	77	56
NDXS1215C	12	15	125	500	27	0.77	0.51	23	40	77	53
NDXS1215EC NDXS2412C	12 24	15 12	125 156	500 625	27 13.8	0.77	0.51	23 24	40 50	77 80	53 55
NDXS2412C	24	12	156	625	13.8	0.38	0.53	24	50	80	55
NDXS2412EC	24	12	125	500	20.6	0.37	0.55	24	45	80	56
NDXS2415C	24	15	125	500	20.6	0.37	0.53	24	45	80	56
NDXS4812C	48	12	156	625	8.8	0.37	0.55	24	40	81	58
NDXS4812EC	48	12	156	625	8.8	0.187	0.47	20	40	81	58
NDXS4815C	48	15	125	500	10.2	0.187	0.47	20	40	82	58
NDXS4815EC	48	15	125	500	10.2	0.187	0.48	20	40	82	58
NDXD0505C	5	±5	±150	±600	19.4	1.83	0110	20	40	67	40
NDXD0505EC	5	±5	±150	±600	19.4	1.83	0.075	20	40	67	40
NDXD0512C	5	±12	±78.1	±312	33.4	2.15		21	45	69	42
NDXD0512EC	5	±12	±78.1	±312	33.4	2.15	0.075	21	45	69	42
NDXD0515C	5	±15	±62.5	±250	41.8	2.69		15	35	71	43
NDXD0515EC	5	±15	±62.5	±250	41.8	2.69	0.075	15	35	71	43
NDXD1205C	12	±5	±187	±750	13.2	0.89		20	45	73	36
NDXD1205EC	12	±5	±187	±750	13.2	0.89	0.176	20	45	73	36
NDXD1212C	12	±12	±78.1	±312	15	0.86		25	55	78	41
NDXD1212EC	12	±12	±78.1	±312	15	0.86	0.159	25	55	78	41
NDXD1215C	12	±15	±62.5	±250	17	0.86		30	60	79	41
NDXD1215EC	12	±15	±62.5	±250	17	0.86	0.175	30	60	79	41
NDXD2405C	24	±5	±187	±750	4.2	0.402		35	60	75	58
NDXD2405EC	24	±5	±187	±750	4.2	0.402	0.15	35	60	75	58
NDXD2412C	24	±12	±78.1	±312	6.3	0.38		25	55	81	56
NDXD2412EC	24	±12	±78.1	±312	6.3	0.38	0.4	25	55	81	56
NDXD2415C	24	±15	±62.5	±250	7	0.38		30	60	82	56
NDXD2415EC	24	±15	±62.5	±250	7	0.38	0.4	30	60	82	56
NDXD4805C	48	±5	±187	±750	3.6	0.198		20	40	77	61
NDXD4805EC	48	±5	±187	±750	3.6	0.198	0.08	20	40	77	61
NDXD4812C	48	±12	±78.1	±312	5.9	0.19		25	45	82	57
NDXD4812EC	48	±12	±78.1	±312	5.9	0.19	0.5	25	45	82	57
NDXD4815C	48	±15	±62.5	±250	5.9	0.19		22	55	82	58
NDXD4815EC	48	±15	±62.5	±250	5.9	0.19	0.5	22	55	82	58
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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 4.

3. See ripple & noise characterisation method.

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

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NDX Series

Isolated 7.5W Wide Input Single & Dual Output DC/DC Converters

INPUT CHARACTERISTICS						
Parameter	Condit	ions	Min.	Тур.	Max.	Units
Voltage range	5V inpu	ut types	4.5	5	9	
	12V in	put types	9	12	18	v
	24V in	put types	18	24	36	v
	48V in	48V input types		48	75	
	outputs	5V input types with 100µF at input		70		
		12V input types with 100μ F at input		18		
	Dual o	24V input types with $10\mu F$ at input		90		
Pofloated ripple ourrent	Du	48V input types with 10µF at input		80		mAnn
Reflected ripple current	uts	5V input types with 100µF at input		115		mA p-p
	outputs	12V input types with 100µF at input		60		
	Single o	24V input types with 10µF at input		50		
	Sing	48V input types with 10µF at input		54		
Ripple & noise ¹	BW=20	OHz to 300kHz, with external input/output capacitors		5	10	mVrms

OUTPUT CHARACTERISTICS

Parameter	Conditions			Min.	Тур.	Max.	Units
Rated power	NDXx0505 types					6.0	W
naleu power	All other types	All other types				7.5	vv
Voltage set point accuracy	With oxformal input/output capacitors		5V & 12V Input		±3	±5	%
		With external input/output capacitors 24V & 48V			±2	±5	70
Line regulation		Dual output	5V & 12V Input		0.1	0.9	%
	Low line to high line, with external input/output capacitors	Dual output	24V & 48V Input		0.04	0.4	
		Single output	All types		0.04	0.4	
		Dual output	5V & 12V input		0.2	0.9	%
Load regulation	25% total load to 100% total load With external input/output capacitors		24V & 48V input		0.2	0.75	
		Single output	All types		0.07	0.20	
Cross regulation		5V & 12V input	5V output		3.8	6	%
	% voltage change on negative output when positive load varies from 25%		12V, 15V output		1.5	5	
(dual outputs)	to 75% with negative load fixed at 100%	24V & 48V input	5V output		2.5	7	
			12V, 15V output		2.5	5	

ABSOLUTE MAXIMUM RATINGS					
Short-circuit protection	12V, 15V outputs	Continuous			
(Max. case temperature rise 95°C above ambient)	5V output, VIN = nominal, 25°C	Continuous			
Lead temperature 1.0mm from case for 10 seconds (to JEDEC JESD22-B106 ISS C)		260°C			
Minimum output load for specification ²	25% of rated load on each output				
Control pin input voltage		7V			
Input voltage, NDXD05,	Input voltage, NDXD05,				
Input voltage, NDXD12, NDXS12 types	20V				
Input voltage, NDXD24, NDXS24 types	40V				
Input voltage, NDXD48, NDXS48 types	80V				

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

1. See ripple & noise characterisation method

2. Please refer to minimum load application notes section on page 4.

NDX Series

Isolated 7.5W Wide Input Single & Dual Output DC/DC Converters

GENERAL CHARACTERIST	ICS						
Parameter	Conditions	Conditions			Тур.	Max.	Units
Switching frequency	100% total load to 25% total load	5V & 12V input	5V, 12V & 15V outputs	100		900	
	(Dual Output Types)	041/ 9 401/ input	5V outputs	100		680	
		24V & 48V input	12V & 15V outputs	100		620	kHz
	100% total load to 25% total load	5V, 12V & 24V input	12V & 15V output	90		850	
	(Single Output Types)	48V input	12V & 15V output	90		600	
		Single outputs		-0.6		0.8	V
	Madula ON (or pip upperpacted)			0		0.1	mA
	Module ON (or pin unconnected)	Dual outputs		-0.6		0.8	V
Control nin innut!				-0.1		0.2	mA
Control pin input ¹		Single outpute		3.0		7.0	V
		Single outputs		0.7		3.0	mA
	Module OFF	Dual autouta		3.0		7.0	V
		Dual outputs		0.3		3.0	mA

TEMPERATURE CHARACTERISTICS								
Parameter	Conditions			Тур.	Max.	Units		
Operation			-40		85			
Storage					130			
Case temperature rise above ambient	100% Load, Nom Vℕ, Still Air	1212, 1215, 2412, 2415, 4812, 4815		35		°C		
		0512, 2405, 4805		43				
	0505, 0515, 1205			48				

MEAN TIME TO FAILURE (MTTF) ²						
Part Number	0°C	25°C	Units			
NDXD2412C	2590	1528				
NDXD2415C	2492	1462	kHrs			
NDXD4812C	2587	1558	KIIIS			
NDXD4815C	2351	1379				

1. See application notes on page 4.

2. Calculated using MIL-HDBK-217F with nominal input voltage at full load.

All specifications typical at TA=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 260°C 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

NDX Series

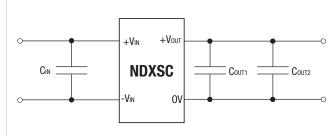
Isolated 7.5W Wide Input Single & Dual Output DC/DC Converters

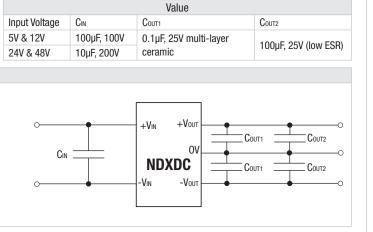
APPLICATION NOTES

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.

Recommended Input & Output Capacitors





Control Pin

Dual Output: 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 $-V_{N}$ pin. **Single Output:** As per dual output, however a series diode must be fitted when the control pin is used on the single output variants. Recommended diode 1N4148 or similar (direction of fitting is cathode to control 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 El 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.

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CHARACTERISATION TEST METHODS

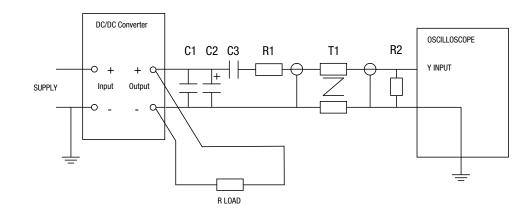
Ripple & Noise Characterisation Method

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

C1	1µF X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter
C2	10μ F 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 $100m\Omega$ 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

Measured values are multiplied by 10 to obtain the specified values.

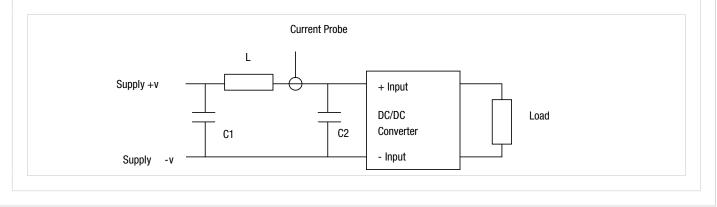
Differential Mode Noise Test Schematic



Input Reflected Ripple Current Test Method

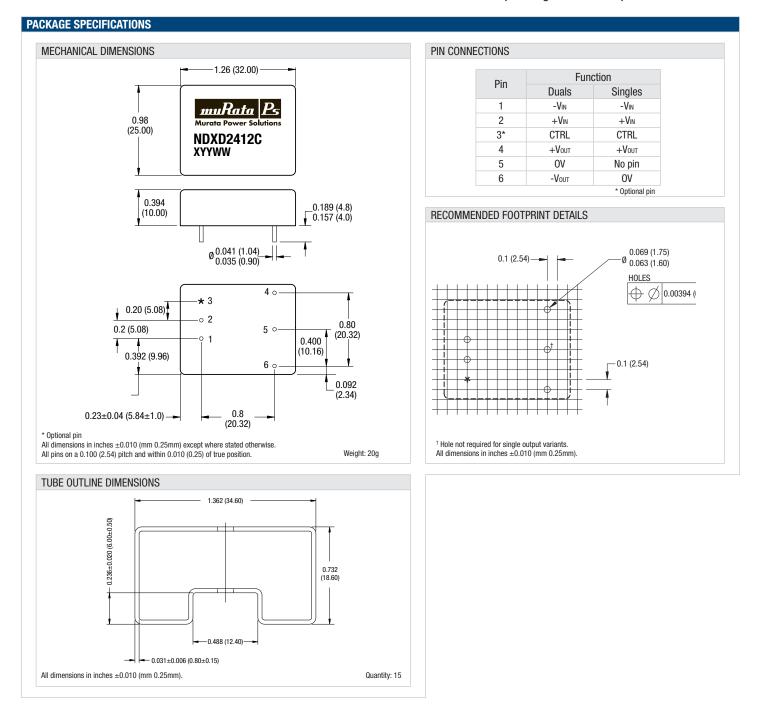
Input reflected ripple current measurements are performed with the following test configuration with the inclusion of recommended input and output capacitors.

С	;1	220uF with ESR of $<0.1\Omega$ at 100kHz, rated at supply voltage	
L	.1	12uH rated at 150% minimum of the DC current taken by the converter.	
С	2	The recommended input capacitor for the DC/DC converter.	



Isolated 7.5W Wide Input Single & Dual Output DC/DC Converters

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