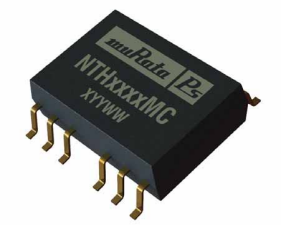
Murata Power Solutions

NTH Series

Isolated 2W Dual Output SM DC-DC Converters



FEATURES

- RoHS compliant
- Efficiency up to 84%
- Wide temperature performance at full 2 Watt load, –40°C to 85°C
- UL 94V-0 package material
- Lead frame technology
- 5V & 12V inputs
- 5V, 9V, 12V & 15V outputs
- Internal SMD construction
- Dual isolated output
- 1kVDC isolation
- MTTF up to 2.17 million hours
- Power density 1.61W/cm^3
- No heatsink required
- Custom solutions available
- Multi layer ceramic capacitors

DESCRIPTION

The NTH series of miniature surface mounted DC-DC converters employ leadframe technology and transfer moulding techniques to bring all of the benefits of IC style packaging to hybrid circuitry. The component lead termination of this product range is lead-free compatible, therefore the converter can be soldered in a lead-free soldering process. Co-planarity of the lead positions is based upon IEC 191-6:1990. The devices are suitable for all applications where high volume production is envisaged.

SELECTION GUIDE

Order Code[1]	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Efficiency	Isolation Capacitance	MTTF[2]	Recommended Alternative
	V	V	mA	mA	%	pF	kHrs	
To be discontinued								
NTH0505MC	5	±5	±200	500	80	27	2175	NMH0505SC
NTH1205MC	12	±5	±200	208	80	35	675	Contact Murata
NTH1209MC	12	±9	±111	201	83	57	472	Contact Murata
NTH1215MC	12	±15	±67	198	84	63	204	NMH1215SC
Discontinued								
NTH0509MC	5	±9	±111	494	81	34	913	NMH0509SC
NTH0512MC	5	±12	±83	488	82	39	465	NMH0512SC
NTH0515MC	5	±15	±67	476	84	37	257	NMH0515SC
NTH1212MC	12	±12	±83	198	84	66	315	NMH1212SC

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 5V input types	4.5	5	5.5	V
	Continuous operation, 12V input types	10.8	12	13.2	
Reflected ripple current	5V input types		40		mA p-p
	12V input types		30		

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated power[3]	T_A=-40°C to 85°C			2.0	W
Voltage set point accuracy	NTHXX05, 10% to 100% load	-5.0		7.5	%
	All other variants, 10% to 100% load	-5.0		5.0	
Line regulation	High V_{IN} to low V_{IN}		1.0	1.2	%/%
Load regulation[2]	10% load to rated load, 5V output types		5.0	10	%
	10% load to rated load, all other output types		3.0	10	
Ripple & noise	BW=DC to 20MHz, 5V output types		150	200	mV p-p
	BW=DC to 20MHz, 9V output types		100	150	
	BW=DC to 20MHz, 12V output types		80	150	
	BW=DC to 20MHz, 15V output types		70	150	

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation test voltage	Flash tested for 1 second	1000			VDC
Resistance	Viso= 500VDC	1	10		GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	All 5V input types		95		kHz
	All 12V input types		90		

RoHS COMPLIANT

For full details go to https://www.murata.com/en-global/products/power/rohs

1. If components are required in tape and reel format suffix order code code with -R, e.g. NTH0505MC-R.
2. Calculated using MIL-HDBK-217F with nominal input voltage at full load.
3. See derating graph.

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	All output types	-40		85	°C
Storage		-55		125	
Case temperature rise above ambient	5V output types		30		
	All other output types		25		
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS	
Internal power dissipation	550mW
Input voltage V_{IN}, NTH05 types	7V
Input voltage V_{IN}, NTH12 types	15V

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 NTH 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 NTH 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 NTH series has toroidal isolation transformers, 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.

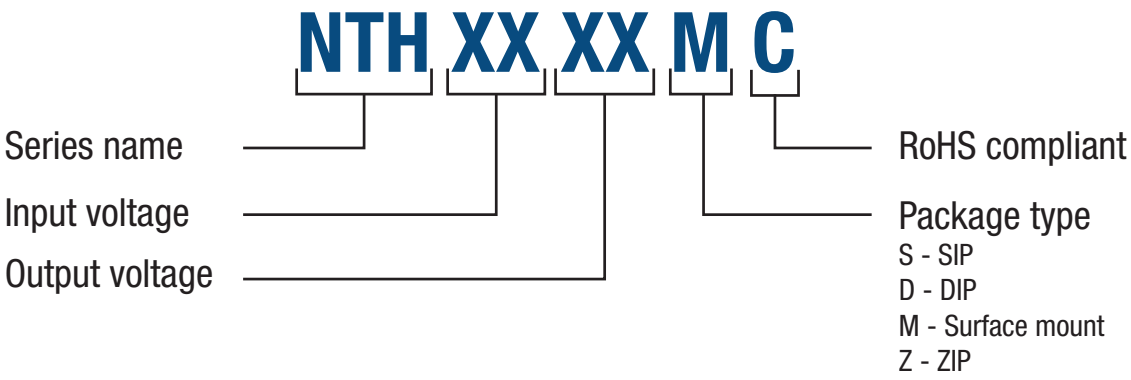
RoHS COMPLIANCE INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak reflow solder temperature of 245ºC and time above liquidus of 217ºC for 60 seconds. Please refer to application notes for further information. The pin termination finish on this product series is Gold, plating thickness 0.1 microns minimum. The series is backward compatible with Sn/Pb soldering systems.

For further information, please visit www.murata-ps.com/rohs

PART NUMBER STRUCTURE



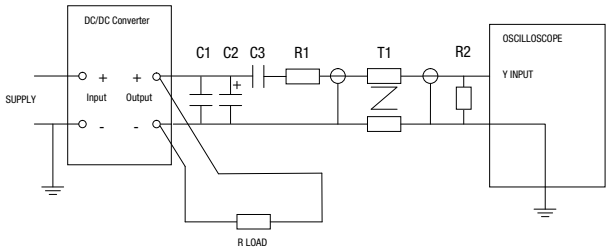
CHARACTERISATION TEST METHODS

Ripple & Noise Characterisation Method

Ripple and noise measurements are performed with the following test configuration.

C1	1µF X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC-DC converter
C2	10µF 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
Measured values are multiplied by 10 to obtain the specified values.	

Differential Mode Noise Test Schematic



APPLICATION NOTES

Minimum load

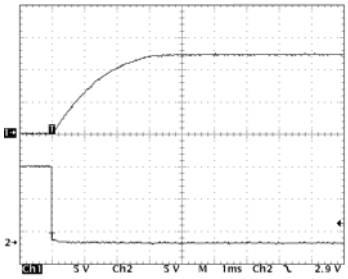
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

Capacitive loading and start up

Typical start up times for this series, with a typical input voltage rise time of 2.2µs and output capacitance of 10µF, are shown in the table below. The product series will start into a capacitance of 47µF with an increased start time, however, the maximum recommended output capacitance is 10µF.

	Start-up time
	µs
NTH0505MC	1026
NTH0509MC	3625
NTH0512MC	5750
NTH0515MC	8330
NTH1205MC	691
NTH1209MC	2645
NTH1212MC	3285
NTH1215MC	6120

Typical Start-Up Wave Form



APPLICATION NOTES (Continued)

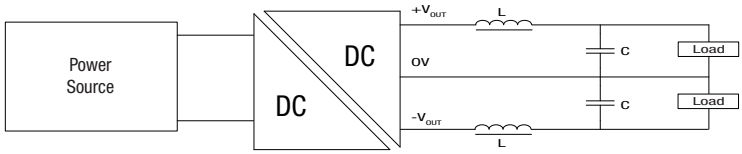
Output Ripple Reduction

By using the values of inductance and capacitance stated, the output ripple at the rated load is lowered to 5mV p-p max.

Component selection

Capacitor: It is required that the ESR (Equivalent Series Resistance) should be as low as possible, ceramic types are recommended.
The voltage rating should be at least twice (except for 15V output), the rated output voltage of the DC-DC converter.

Inductor: The rated current of the inductor should not be less than that of the output of the DC-DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC-DC converter. The SRF (Self Resonant Frequency) should be >20MHz.

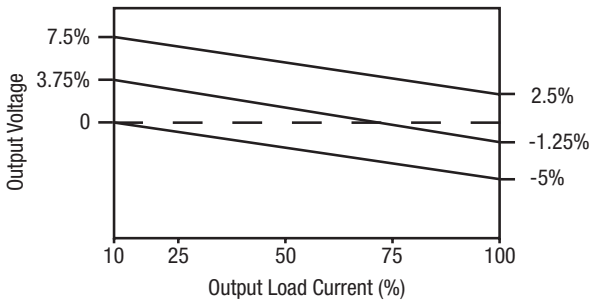


	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
NTH0505MC	10	82103C	11R103C	4.7
NTH0509MC	22	82223C	11R223C	2.2
NTH0512MC	47	82473C	11R473C	1
NTH0515MC	220	82474C	11R474C	0.22
NTH1205MC	10	82103C	11R103C	4.7
NTH1209MC	22	82223C	11R223C	2.2
NTH1212MC	47	82473C	11R473C	1
NTH1215MC	220	82474C	11R474C	0.22

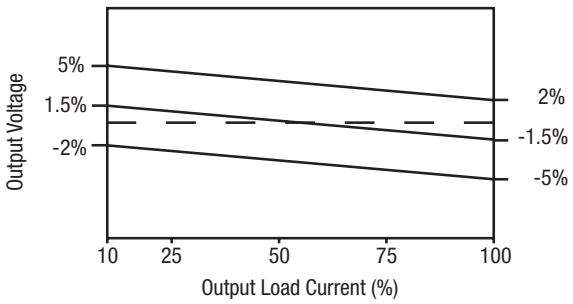
TOLERANCE ENVELOPES

The voltage tolerance envelope shows typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to changes in output loading.

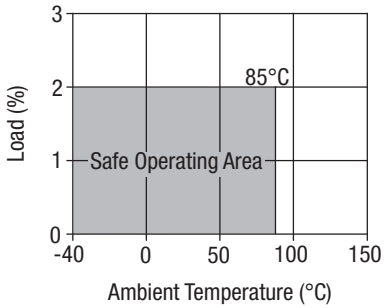
NTH05XXMC



NTH12XXMC

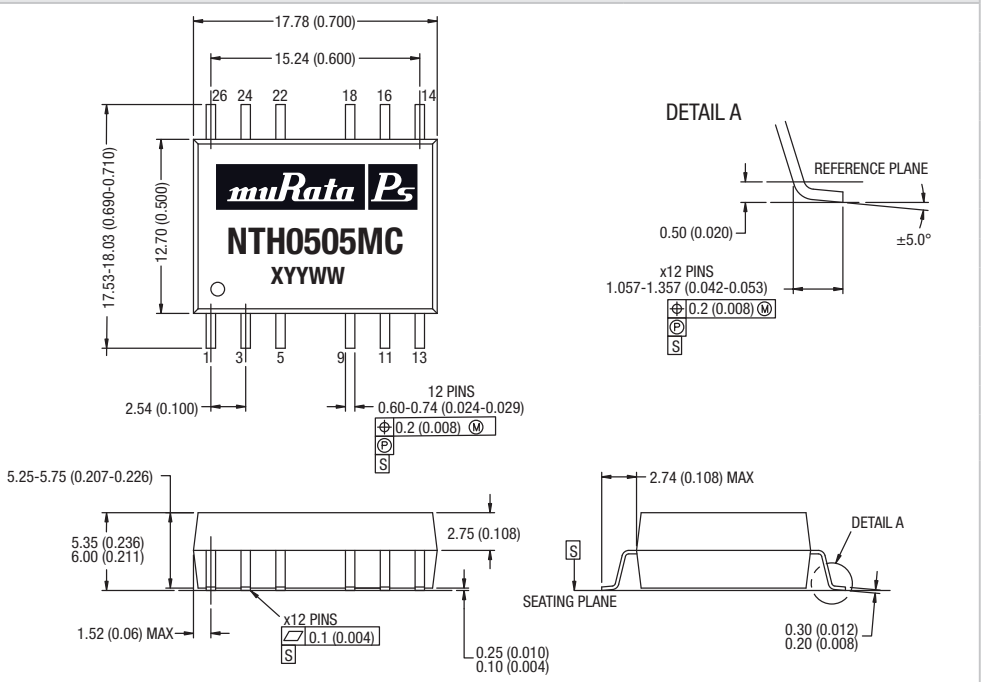


TEMPERATURE DERATING GRAPH



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



All dimensions in mm (inches). Controlling dimension is mm.

Tolerance (unless otherwise stated) ±0.25 (±0.01). All pins on a 2.54 (0.1) pitch.

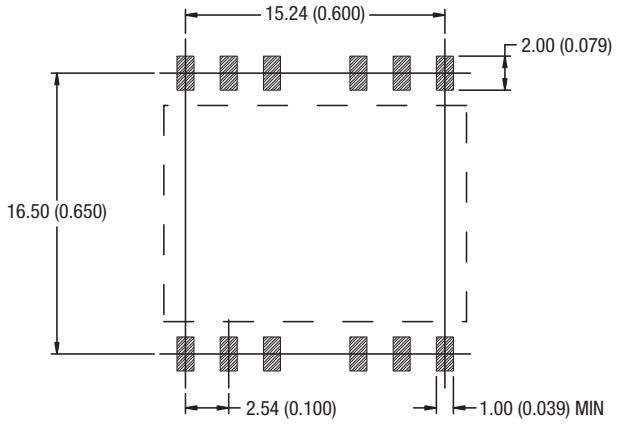
Weight: 2.75g

PIN CONNECTIONS

Pin	Function
1	$-V_{IN}$
3	$+V_{IN}$
5	NA
9	$-V_{OUT}$
11	0V
13	$+V_{OUT}$
14	NA
16	NA
18	$-V_{OUT}$
22	NC
24	NA
26	NA

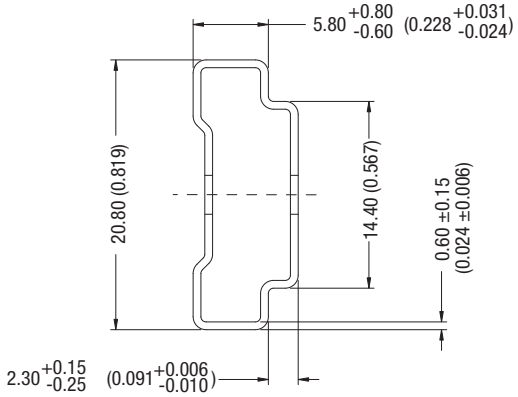
NA - Not available for electrical connection.
NC - No internal electrical connection.

RECOMMENDED FOOTPRINT DETAILS



All dimensions in mm ±0.5 (inches ±0.02)

TUBE OUTLINE DIMENSIONS

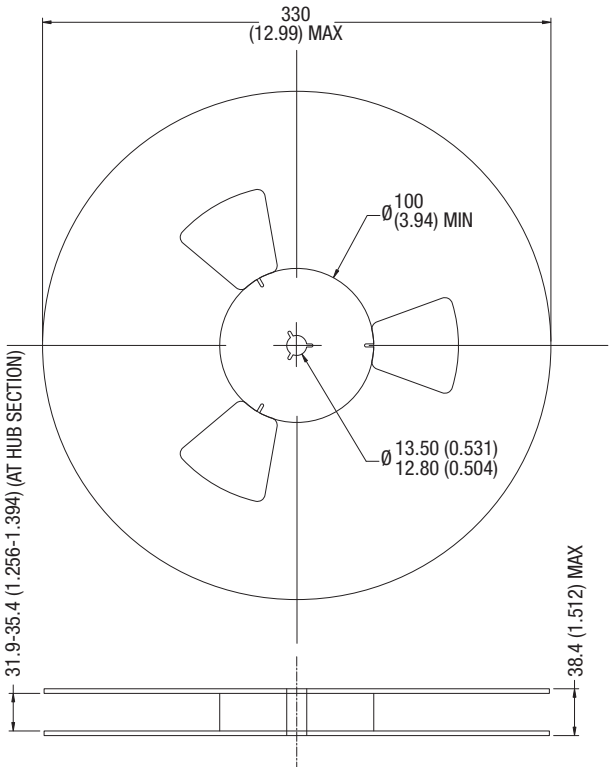


All dimensions in mm ±0.5 (inches ±0.02).
Tube length: 475 ±2.0 (18.70 ±0.079).

Tube Quantity: 25

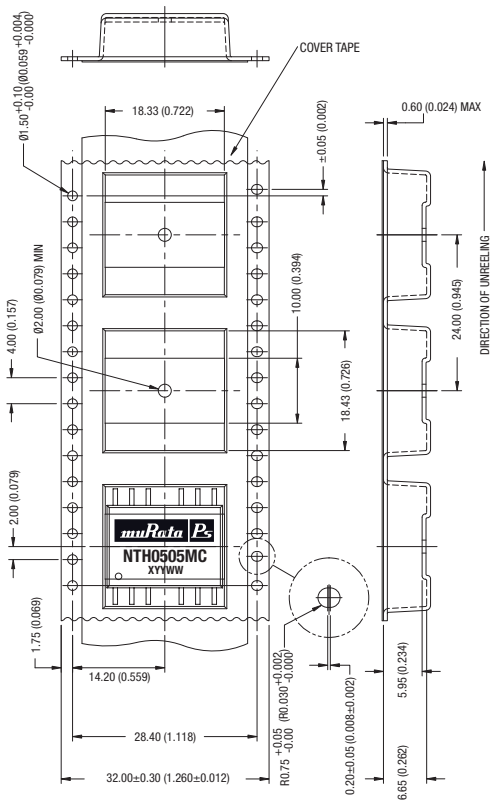
TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS



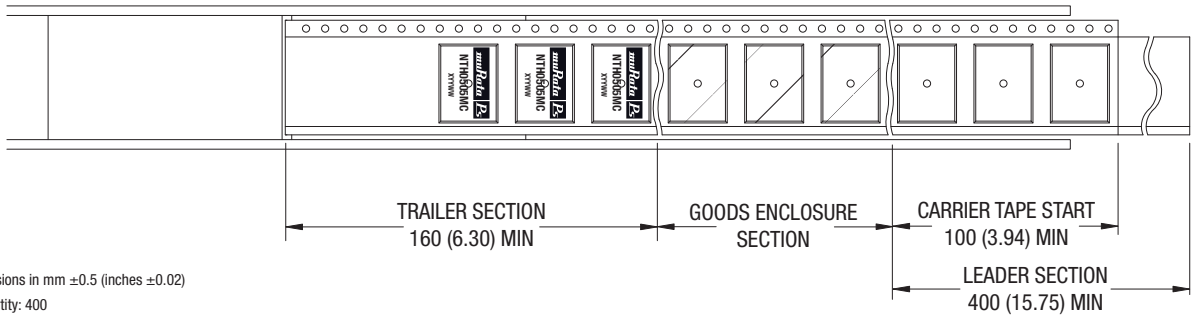
All dimensions in mm ±0.5 (inches ±0.02)

TAPE OUTLINE DIMENSIONS



All dimensions in mm ±0.5 (inches ±0.02)

REEL PACKAGING DETAILS



All dimensions in mm ±0.5 (inches ±0.02)
Reel Quantity: 400

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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.

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- Aircraft equipment
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- 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

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