OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 85°C, see derating graph			2	W
Voltage Set Point Accuracy	NMH0505XC	-5		7.5	%
	All other types	-5		5	
Line regulation	High V_{IN} to low V_{IN}		1.0	1.2	%/%
Load Regulation	10% load to rated load, 5V output types		5	10	%
	10% load to rated load, 9V output types		3	10	
	10% load to rated load, 12V output types				
	10% load to rated load, 15V output types				
Ripple and 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= 500V	1	10		GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	5V input types		95		kHz
	12V input types		90		
	24V & 48V input types		80		

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		130	
Case Temperature above ambient	5V output types		30		
	12V output types		25		
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS

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.
Input voltage V_{IN}, NMH05 types	7V
Input voltage V_{IN}, NMH12 types	15V
Input voltage V_{IN}, NMH24 types	28V
Input voltage V_{IN}, NMH48 types	54V

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 NMH 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 NMH 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 NMH 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.

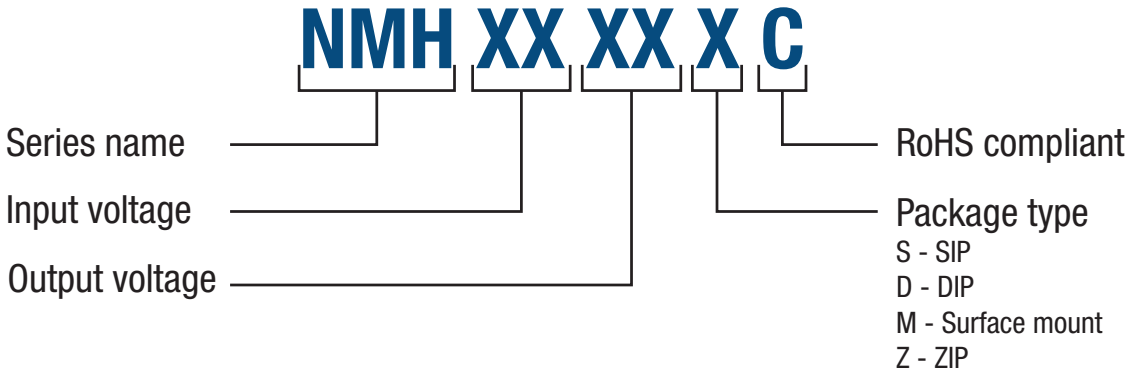
This consideration equally applies to agency recognised parts rated for better than functional isolation where the wire enamel insulation is always supplemented by a further insulation system of physical spacing or barriers.

RoHS COMPLIANCE INFORMATION

RoHS COMPLIANT

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

PART NUMBER STRUCTURE



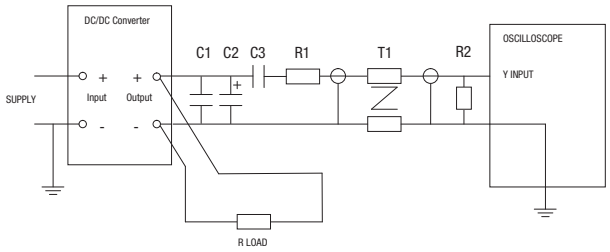
CHARACTERISATION TEST METHODS

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%.

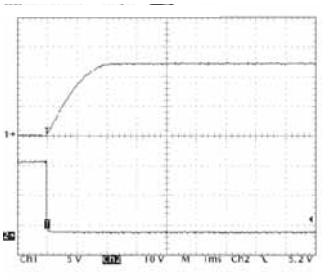
Capacitive loading and start up

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
NMH0505XC	1072
NMH0509XC	2481
NMH0512XC	3546
NMH0515XC	5380
NMH1205XC	672
NMH1209XC	1152
NMH1212XC	1580
NMH1215XC	3150

	Start-up time
	µs
NMH2405XC	1064
NMH2409XC	1544
NMH2412XC	4398
NMH2415XC	4230
NMH4805XC	966
NMH4809XC	1220
NMH4812XC	2822
NMH4815XC	4275

Typical Start-Up Wave Form



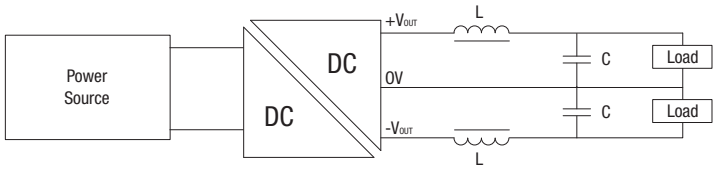
APPLICATION NOTES (Continued)

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.



Order Code	L (µH)	Inductor Order Codes		C (µF)
		SMD	Through Hole	
NMH0505XC	47	82473C	11R473C	4.7
NMH0509XC	47	82473C	11R473C	2.2
NMH0512XC	150	82154C	11R154C	3.3
NMH0515XC	100	82104C	11R104C	3.3
NMH1205XC	47	82473C	11R473C	4.7
NMH1209XC	47	82473C	11R473C	2.2
NMH1212XC	150	82154C	11R154C	3.3
NMH1215XC	100	82104C	11R104C	3.3
NMH2405XC	47	82473C	11R473C	4.7
NMH2409XC	47	82473C	11R473C	2.2
NMH2412XC	150	82154C	11R154C	3.3
NMH2415XC	100	82104C	11R104C	3.3
NMH4805XC	47	82473C	11R473C	4.7
NMH4809XC	47	82473C	11R473C	2.2
NMH4812XC	150	82154C	11R154C	3.3
NMH4815XC	100	82104C	11R104C	3.3

Product specification for MPS inductors can be found at:

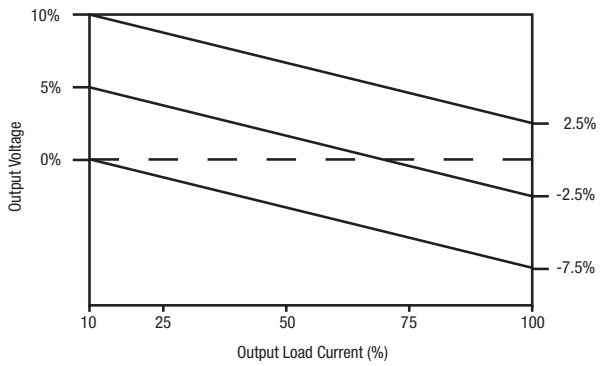
1100R Series (Through Hole)
http://www.murata-ps.com/data/magnetics/kmp_1100r.pdf

8200 Series (SMD)
http://www.murata-ps.com/data/magnetics/kmp_8200c.pdf

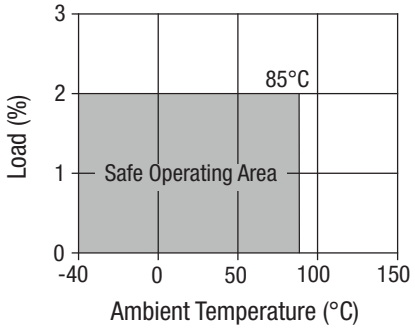
TOLERANCE ENVELOPES

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

NMH



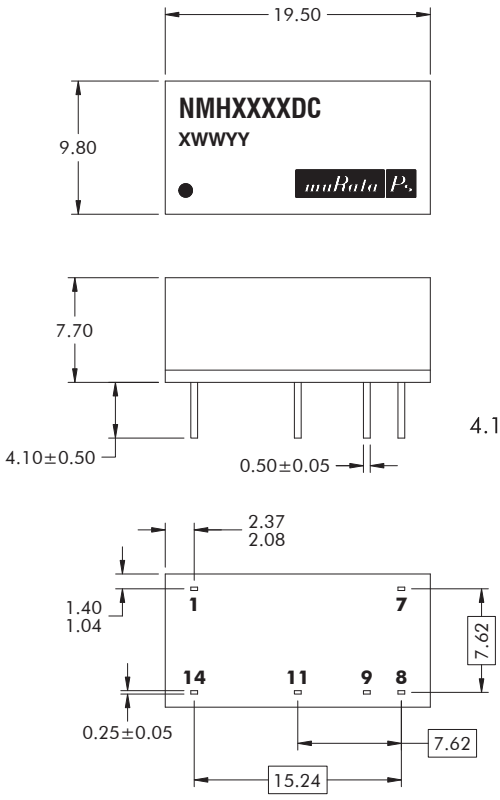
TEMPERATURE DERATING GRAPH



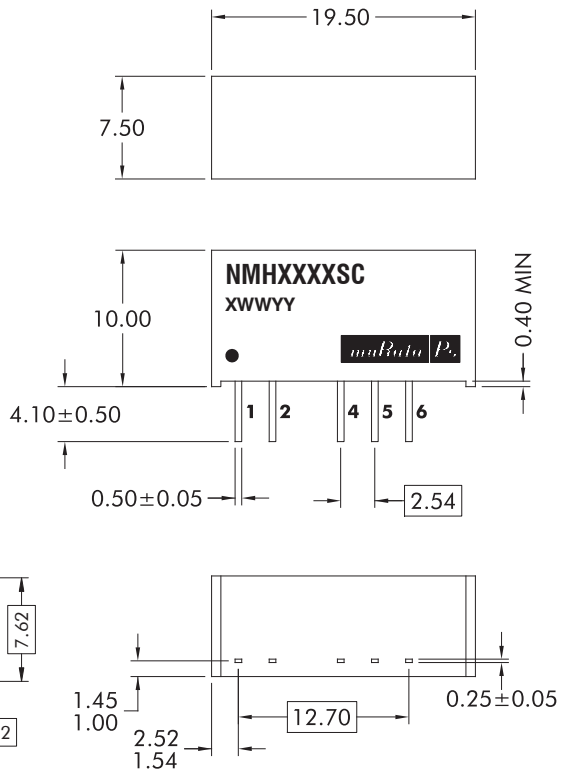
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

DIP package



SIP package



Unless otherwise stated all dimensions in mm ±0.25mm.

All pins on a 2.54mm pitch and within 0.25mm of true position.

Weight: 2.85g (DIP) 2.76g (SIP)

PIN CONNECTIONS - 14 PIN DIP

Pin	Function
1	-V_{IN}
7	NC
8	0V
9	+V_{OUT}
11	-V_{OUT}
14	+V_{IN}

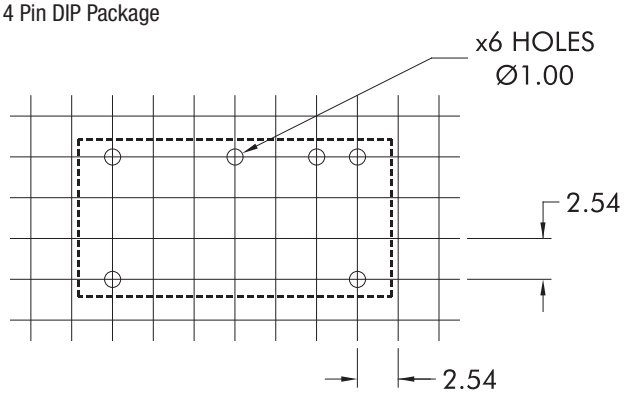
PIN CONNECTIONS - 7 PIN SIP

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

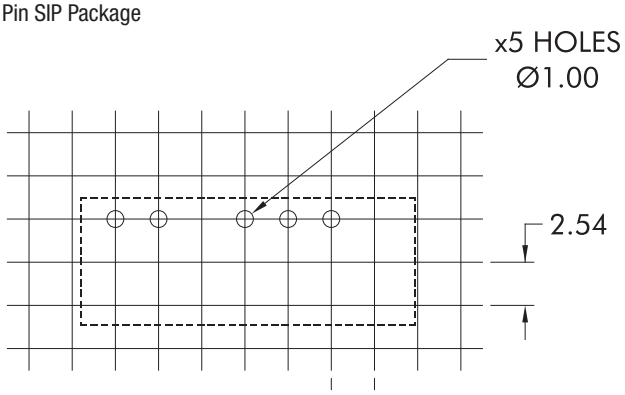
PACKAGE SPECIFICATIONS (Continued)

RECOMMENDED FOOTPRINT DETAILS

14 Pin DIP Package

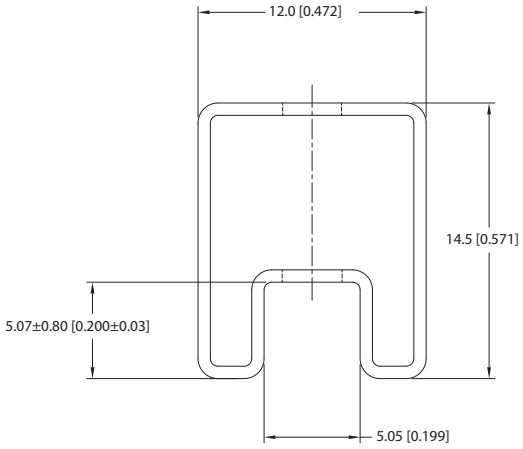


7 Pin SIP Package

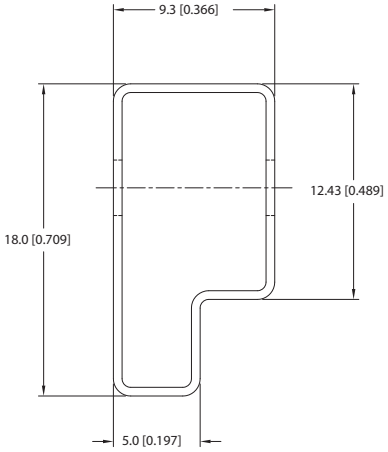


TUBE OUTLINE DIMENSIONS

14 Pin DIP Tube



7 Pin SIP Tube



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].Tube length (14 Pin DIP) : 520mm [20.472] ±2.0 [0.079].
Tube length (7 Pin SIP) : 520mm [20.472] ±2.0 [0.079].

Tube Quantity : 25

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- Power plant control equipment
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- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Data Processing equipment

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