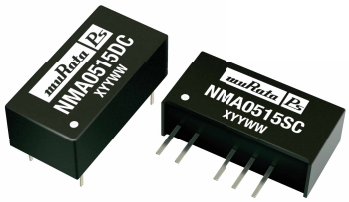
Murata Power Solutions

NMA 5V, 12V & 15V Series

Isolated 1W Dual Output DC/DC Converters



FEATURES

- Efficiency up to 80%
- Wide temperature performance at full 1 Watt load, –40°C to 85°C
- Dual output from a single input rail
- Industry standard pinout
- Power sharing on output
- 1kVDC isolation 'Hi Pot Test'
- 5V, 12V, & 15V input
- 5V, 9V, 12V and 15V output
- Internal SMD construction
- Fully encapsulated with toroidal magnetics
- No external components required
- MTTF up to 3.1 million hours
- Pin compatible with NKA & MEA1 series
- No electrolytic or tantalum capacitors

DESCRIPTION

The NMA series of industrial temperature range DC/DC converters are the standard building blocks for on-board distributed power systems. They are ideally suited for providing dual rail supplies on primarily digital boards with the added benefit of galvanic isolation to reduce switching noise. All of the rated power may be drawn from a single pin provided the total load does not exceed 1 watt.

SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Efficiency	Isolation Capacitance	MTTF[1]	Package Style
	V	V	mA	mA	%	pF	kHrs	
NMA0505DC	5	±5	±100	289	69	28	3103	DIP
NMA0509DC	5	±9	±55	267	75	32	2257	
NMA0512DC	5	±12	±42	260	77	34	1579	
NMA0515DC	5	±15	±33	256	78	36	1065	
NMA0505SC	5	±5	±100	289	69	28	3103	SIP
NMA0509SC	5	±9	±55	267	75	32	2257	
NMA0512SC	5	±12	±42	260	77	34	1579	
NMA0515SC	5	±15	±33	256	78	36	1065	
NMA1205DC	12	±5	±100	120	69	33	2193	DIP
NMA1209DC	12	±9	±55	113	74	46	1734	
NMA1212DC	12	±12	±42	111	75	55	1303	
NMA1215DC	12	±15	±33	110	76	54	932	
NMA1205SC	12	±5	±100	120	69	33	2193	SIP
NMA1209SC	12	±9	±55	113	74	46	1734	
NMA1212SC	12	±12	±42	111	75	55	1303	
NMA1215SC	12	±15	±33	110	76	54	932	
NMA1505DC	15	±5	±100	91	71	39	1941	DIP
NMA1512DC	15	±12	±42	87	78	68	790	
NMA1515DC	15	±15	±33	84	80	84	523	
NMA1505SC	15	±5	±100	91	71	39	1941	SIP
NMA1512SC	15	±12	±42	87	78	68	790	
NMA1515SC	15	±15	±33	84	80	84	523	

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	
	Continuous operation, 15V input types	13.5	15	16.5	
Reflected ripple current			20	40	mA p-p

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	260°C
Input voltage V_{IN}, NMA05 types	7V
Input voltage V_{IN}, NMA12 types	15V
Input voltage V_{IN}, NMA15 types	18V

RoHS COMPLIANT

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

1. Calculated using MIL-HDBK-217FN2 calculation model with nominal input voltage at full load.

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

OUTPUT CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 120°C, see derating graph				1	W
Voltage Set Point Accuracy	See tolerance envelope					
Line regulation	High V_{IN} to low V_{IN}			1.0	1.2	%/%
Load Regulation 10% load to rated load	5V & 12V input	5V output types		10	12.5	%
		9V output types		9	10	
		12V output types		6.5	7.5	
		15V output types		6	7.0	
	15V input	5V output types		5.5	10	
		12V output types		2.6	3.0	
		15V output types		2.3	3.0	
Ripple and Noise[1]	BW=DC to 20MHz, 5V output types			10	20	mV p-p
	BW=DC to 20MHz, 9V output types			7	15	
	BW=DC to 20MHz, 12V output types			7.5	15	
	BW=DC to 20MHz, 15V output types			8	15	

ISOLATION CHARACTERISTICS

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

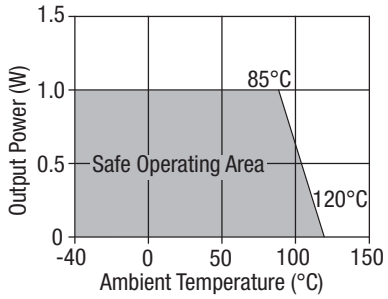
GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	5V input types		110		kHz
	12V input types		140		
	15V input types		90		

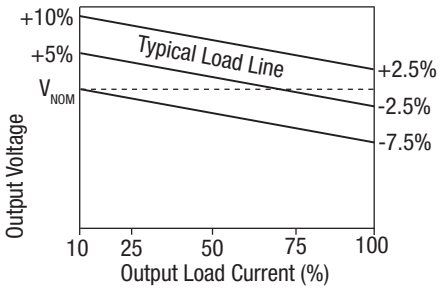
TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		130	
Case Temperature above ambient	0505, 1205		33		
	0509, 0512, 0515, 1209, 1212, 1215		28		
	1505		26		
	1512, 1515		17		
Cooling	Free air convection				

TEMPERATURE DERATING GRAPH



TOLERANCE ENVELOPE



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.

1. See Ripple & Noise characterisation method.

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 NMA 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 NMA 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 NMA series has toroidal isolation transformers, 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.

RoHS COMPLIANT INFORMATION

RoHS COMPLIANT

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 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

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%.

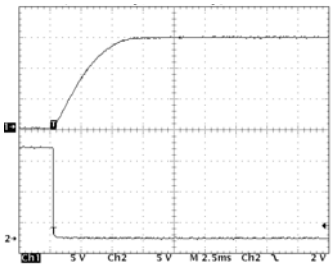
Capacitive loading and start up

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
NMA0505xC	2018
NMA0509xC	6610
NMA0512xC	14520
NMA0515xC	20200
NMA1205xC	1061
NMA1209xC	3935

	Start-up time µs
NMA1212xC	9765
NMA1215xC	15980
NMA1505xC	1060
NMA1512xC	1627
NMA1515xC	6275

Typical Start-Up Wave Form



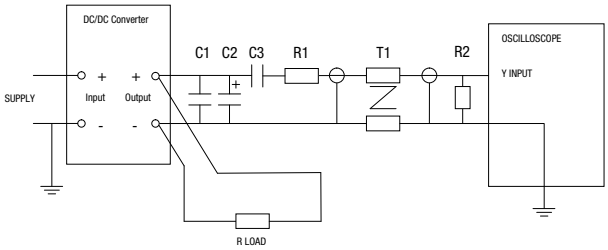
APPLICATION NOTES (continued)

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



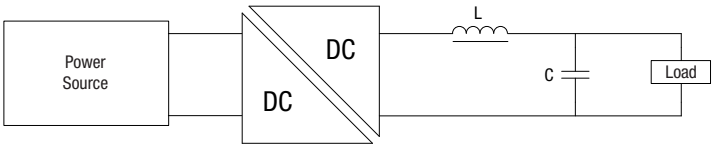
Output Ripple Reduction

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.

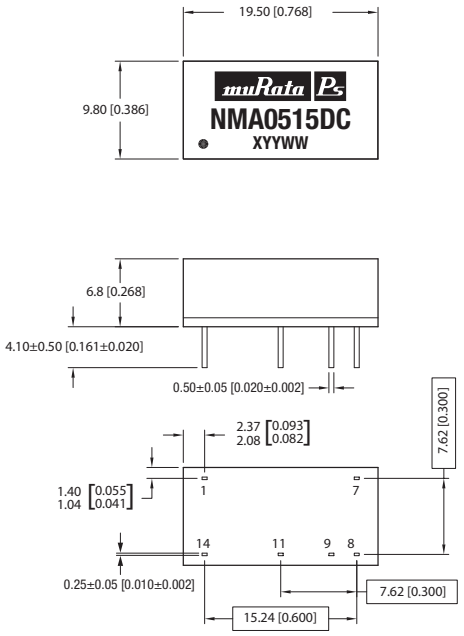


	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
NMA0505xC	22	82223C	11R223C	2.2uF
NMA0509xC	100	82104C	11R104C	0.47uF
NMA0512xC	150	82154C	11R154C	0.33uF
NMA0515xC	220	82224C	11R224C	1uF
NMA1205xC	22	82223C	11R223C	2.2uF
NMA1209xC	47	82473C	11R473C	1uF
NMA1212xC	150	82154C	11R154C	0.33uF
NMA1215xC	220	82224C	11R224C	1uF
NMA1505xC	22	82223C	11R223C	2.2uF
NMA1512xC	150	82154C	11R154C	0.33uF
NMA1515xC	220	82224C	11R224C	2.2uF

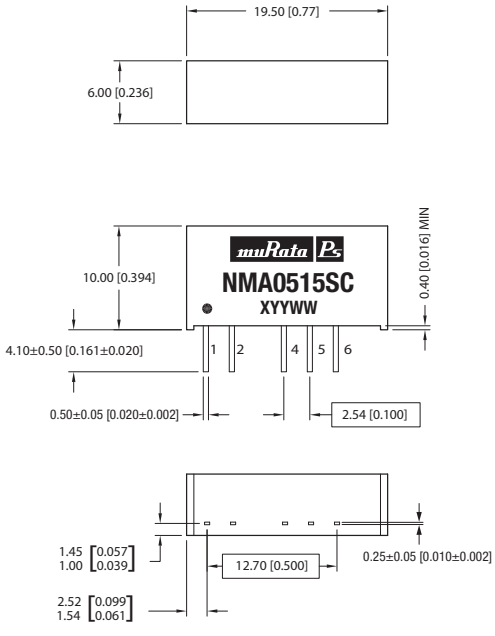
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

DIP package



SIP package



Controlling dimension is mm.
Unless otherwise stated all dimensions in mm (inches) ±0.25mm (0.010").
All pins on a 2.54mm (0.100") pitch and within 0.25mm (0.010") of true position.

Weight: 2.4g (DIP) 2.1g (SIP)

PIN CONNECTIONS - 14 PIN DIP

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

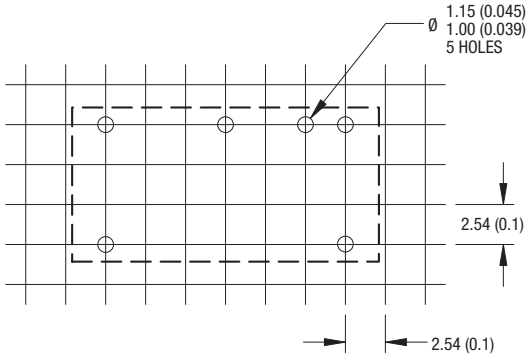
PIN CONNECTIONS - 7 PIN SIP

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

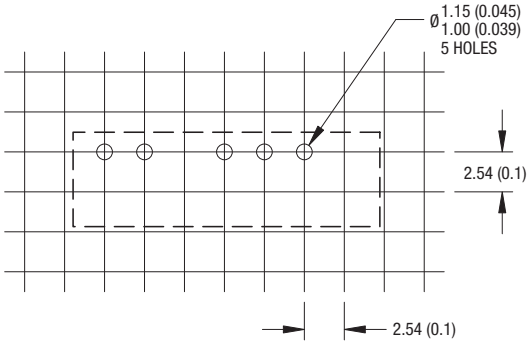
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

14 Pin DIP Package

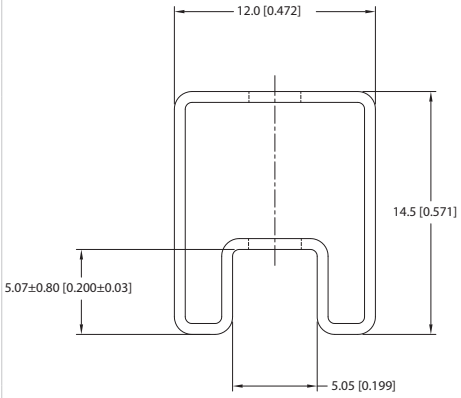


7 Pin SIP Package

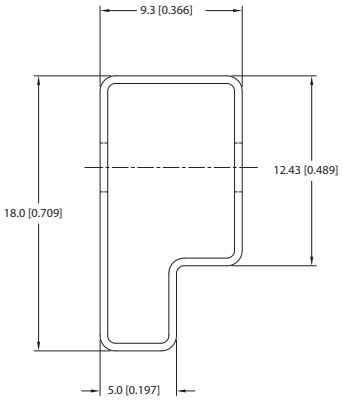


TUBE OUTLINE DIMENSIONS

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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