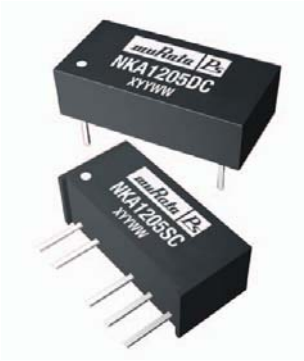
Murata Power Solutions

NKA Series

Isolated Sub-Miniature 1W Dual Output DC/DC Converters



FEATURES

- RoHS compliant
- Efficiency up to 82%
- Wide temperature performance at full 1 Watt load, –40°C to 85°C
- UL 94V-0 package material
- Reduced footprint at 0.98cm²
- Industry standard pinout
- Power sharing on output
- 3.3V, 5V & 12V Input
- 3.3V, 5V, 9V, 12V and 15V output
- Internal SMD construction
- Fully encapsulated with toroidal magnetics
- No external components required
- MTTF up to 1.6 Million hours
- No electrolytic or tantalum capacitors

DESCRIPTION

The NKA sub-miniature series of industrial temperature range DC/DC converters are the standard building blocks for on-board distributed power systems. The series offers smaller package size, improved efficiency, lower output ripple and 3kVDC isolation capability through the use of state of the art packaging and technology. 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.

RoHS COMPLIANT

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

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	
NKA0303DC	3.3	±3.3	±152	407	74	20	195	DIP
NKA0305DC	3.3	±5	±100	383	79	22	1121	
NKA0309DC	3.3	±9	±56	402	75	30	1035	
NKA0312DC	3.3	±12	±42	390	78	31	375	
NKA0315DC	3.3	±15	±33	384	79	32	206	
NKA0303SC	3.3	±3.3	±152	407	74	20	195	SIP
NKA0305SC	3.3	±5	±100	383	79	22	1121	
NKA0309SC	3.3	±9	±56	402	75	30	1035	
NKA0312SC	3.3	±12	±42	390	78	31	375	
NKA0315SC	3.3	±15	±33	384	79	32	206	
NKA0503DC	5	±3.3	±152	259	77	22	205	DIP
NKA0505DC	5	±5	±100	285	70	21	1697	
NKA0505DEC	5	±5	±100	249	80	26	1557	
NKA0509DC	5	±9	±56	263	76	25	682	
NKA0512DC	5	±12	±42	255	78	28	343	
NKA0515DC	5	±15	±33	253	79	29	188	
NKA0503SC	5	±3.3	±152	259	77	22	205	SIP
NKA0505SC	5	±5	±100	285	70	21	1697	
NKA0505SEC	5	±5	±100	249	80	26	1557	
NKA0509SC	5	±9	±56	263	76	25	682	
NKA0512SC	5	±12	±42	255	78	28	343	
NKA0515SC	5	±15	±33	253	79	29	188	
NKA1205DC	12	±5	±100	112	74	33	559	DIP
NKA1209DC	12	±9	±56	106	79	48	375	
NKA1212DC	12	±12	±42	104	81	55	243	
NKA1215DC	12	±15	±33	102	82	60	154	
NKA1205SC	12	±5	±100	112	74	33	559	SIP
NKA1209SC	12	±9	±56	106	79	48	375	
NKA1212SC	12	±12	±42	104	81	55	243	
NKA1215SC	12	±15	±33	102	82	60	154	

NKA0505DEC/NKA0505SEC offer higher efficiency than NKA0505SC/NKA0505DC but over a narrower operating temperature range. See temperature characteristics graph.

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 3.3V input types	2.97	3.3	3.63	V
	Continuous operation, 5V input types	4.5	5	5.5	
	Continuous operation, 12V input types	10.8	12	13.2	
Reflected ripple current	3.3V input types		30	60	mA p-p
	All other types		20	35	

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	300°C
Internal power dissipation	550mW
Input voltage V_{IN}, NKA03 types	5.5V
Input voltage V_{IN}, NKA05 types	7V
Input voltage V_{IN}, NKA12 types	15V

1. Calculated using MIL-HDBK-217F 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[1]	T_A=-40°C to 120°C			1	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN}		1.0	1.2	%/%
Load Regulation[2]	10% load to rated load, 0312 & 0315		8	14	%
	10% load to rated load, 3.3V output types		10	15	
	10% load to rated load, 5V output types		10	12	
	10% load to rated load, 9V output types		6.5	8	
	10% load to rated load, 12V output types		6	8.5	
	10% load to rated load, 15V output types		6	7	
Ripple and Noise	BW=DC to 20MHz, 0312 & 0315		25	60	mV p-p
	BW=DC to 20MHz, 3.3V output types		40	80	
	BW=DC to 20MHz, 5V output types		50	75	
	BW=DC to 20MHz, 9V output types		40	65	
	BW=DC to 20MHz, 12V output types		40	60	
	BW=DC to 20MHz, 15V output types		40	60	

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation test voltage	Flash tested for 1 second	3000			VDC
Resistance	Viso= 1000VDC		10		GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	0303, 0305, 0312, 0315, 0503 and 0505XE		95		kHz
	All other types		120		

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		130	
Case temperature rise above ambient	5V output types		30		
	All other output types		21		
Cooling	Free air convection				

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 NKA 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 NKA 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

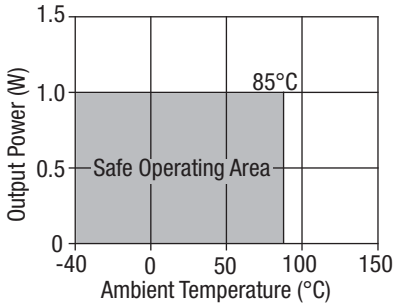
It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. The NKA series has toroidal isolation transformers, with no additional insulation between 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.

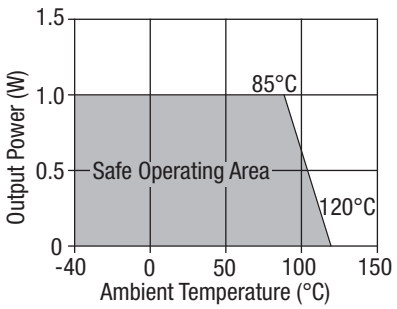
1. See Derating Graphs.
2. 12V input types have typically 3% less load regulation.

TEMPERATURE DERATING GRAPHS

NKA0303DC/SC, 0305DC/SC 0309DC/SC, 0505DEC/SEC types only.

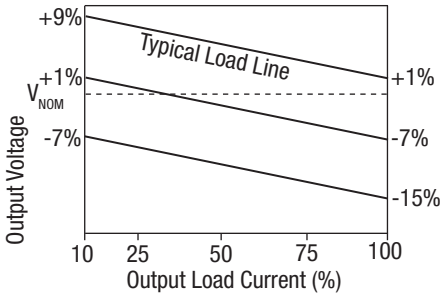


All other types.

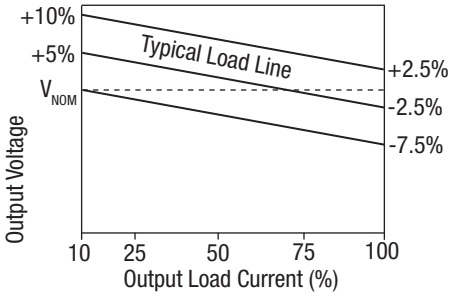


TOLERANCE ENVELOPES

3.3V output types.



All other types.



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.

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%.

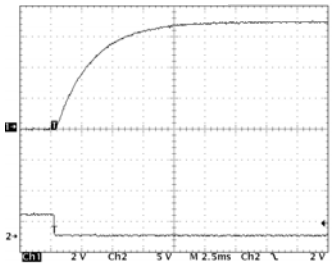
Capacitive loading and start up

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 ms
NKA0303SC	1.35
NKA0305SC	3.35
NKA0309SC	9.30
NKA0312SC	22.13
NKA0315SC	25.04
NKA0503SC	0.80
NKA0505SC	2.32
NKA0505SEC	2.03

	Start-up time ms
NKA0509SC	8.01
NKA0512SC	14.63
NKA0515SC	28.38
NKA1205SC	2.11
NKA1209SC	7.62
NKA1212SC	9.08
NKA1215SC	14.39

Typical Start-Up Wave Form

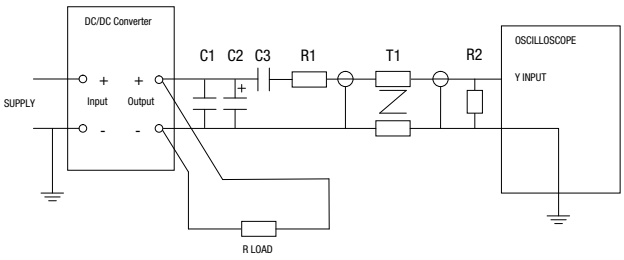


Ripple & Noise Characterisation Method

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 (continued)

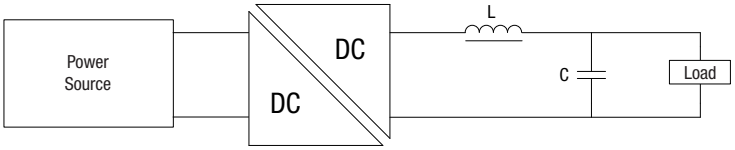
Output Ripple Reduction

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.

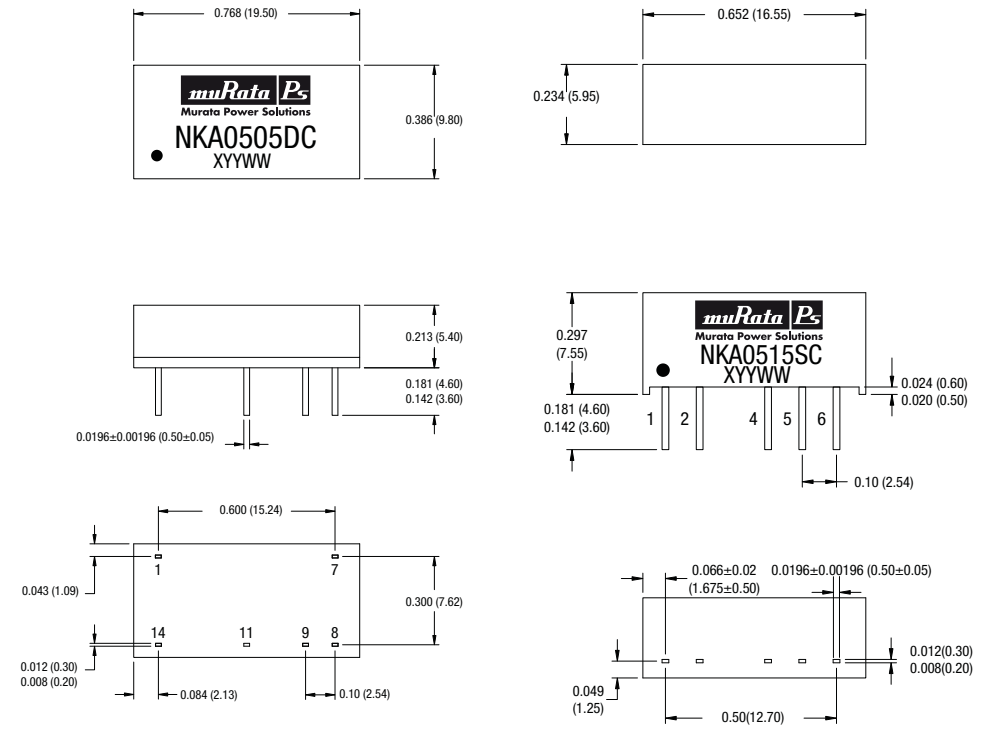
Inductor: The rated current of the inductor should not be less than that of the output of the DC/DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC/DC converter. The SRF (Self Resonant Frequency)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



	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
NKA0303xC	10	82103C	11R103C	1uF
NKA0305xC	22	82223C	11R223C	2.2uF
NKA0309xC	47	82473C	11R473C	2.2uF
NKA0312xC	68	82683C	11R683C	3.3uF
NKA0315xC	470	82474C	11R474C	2.2uF
NKA0503xC	10	82103C	11R103C	1uF
NKA0505xC	22	82223C	11R223C	2.2uF
NKA0505xEC	22	82223C	11R223C	2.2uF
NKA0509xC	47	82473C	11R473C	2.2uF
NKA0512xC	150	82154C	11R154C	0.33uF
NKA0515xC	470	82474C	11R474C	2.2uF
NKA1205xC	22	82223C	11R223C	2.2uF
NKA1209xC	47	82473C	11R473C	2.2uF
NKA1212xC	150	82154C	11R154C	0.33uF
NKA1215xC	470	82474C	11R474C	2.2uF

PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



All dimensions in inches ±0.01 (mm ±0.25mm). All pins on a 0.1 (2.54) pitch and within ±0.01 (0.25) of true position.

Weight: 1.4g (SIP) 1.9g (DIP)

PIN CONNECTIONS - 14 PIN DIP

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

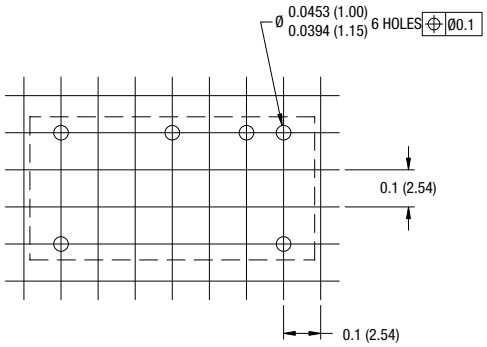
PIN CONNECTIONS - 6 PIN SIP

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

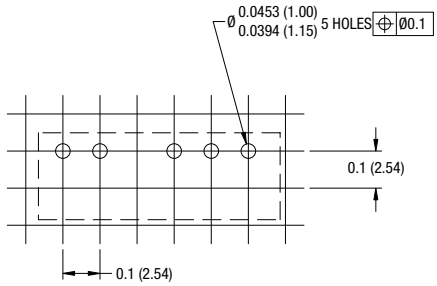
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

14 Pin DIP Package

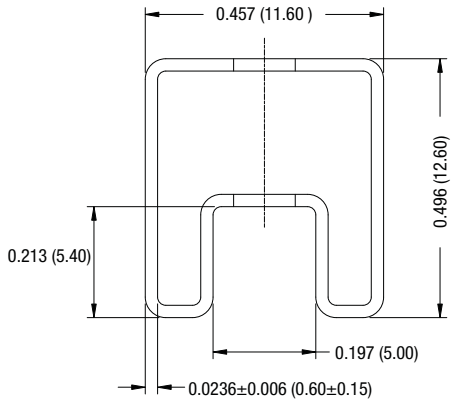


6 Pin SIP Package

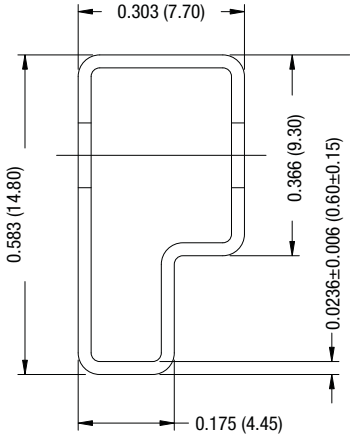


TUBE OUTLINE DIMENSIONS

14 Pin DIP Tube



6 Pin SIP Tube



Unless otherwise stated all dimensions in inches (mm) ±0.5mm.
Tube length (14 Pin DIP) : 20.47 (520mm ±2mm).
Tube length (6 Pin SIP) : 20.67 (525mm ±2mm).

DIP Tube Quantity : 25
SIP Tube Quantity : 30

RoHS COMPLIANCE INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 300°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

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ISO 9001 and 14001 REGISTERED

This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:
Refer to: http://www.murata-ps.com/requirements/