

FEATURES

- ◆RoHS Compliant
- ◆Sub-Miniature SIP4&DIP8 Styles
- ◆3kVDC Isolation
- ◆Wide Temperature performance at full 1 Watt load, -40°C to 85°C
- ◆Increased Power Density to 2.09W/cm³
- ◆UL 94V-0 Package Material
- ◆Footprint at 0.69cm²
- ◆Industry Standard Pin out
- ◆3.3V,5V&12V Input
- ◆3.3V,5V,9V,12Vand15V Output
- ◆Internal SMD Construction
- ◆Fully Encapsulated with Toroidal Magnetics
- ◆MTTF up to 2.6 Million hours
- ◆Custom Solutions Available
- ◆No Electrolytic or Tantalum Capacitors

MODEL SELECTION

NKE^①05^②05^③XS(D)C^④

- ①Product Series ②Input Voltage
③Output Voltage ④Fixed Input&SIP4(DIP8)Package

APPLICATIONS

The NKE sub-miniature series of DC/DC Converters is particularly suited to isolating and/or converting DC power rails. A smaller package size, improved efficiency, lower output ripple and 3kVDC isolation capability through state of the art packaging and improved technology. The galvanic isolation allows the device to be configured to provide an isolated negative rail in systems where only positive rails exist. The wide temperature range guarantees startup from -40°C and full 1 watt output at 85°C.



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SELECTION GUIDE

Order code	Input		Output		Efficiency (% Typ.)	Isolation Capacitance pF	MTTF ¹ KHrs
	Voltage(VDC)	Current (mA)	Voltage (VDC)	Current (mA)			
	Nominal	Rated Load					
NKE0303XDC	3.3	400	3.3	303	72	30	1234
NKE0305XDC	3.3	400	5	200	75	35	632
NKE0309XDC	3.3	403	9	111	74	30	1204
NKE0312XDC	3.3	398	12	83	76	33	---
NKE0315XDC	3.3	394	15	66	77	35	---
NKE0303XSC	3.3	400	3.3	303	72	30	1234
NKE0305XSC	3.3	400	5	200	75	35	632
NKE0309XSC	3.3	403	9	111	74	30	1204
NKE0503XDC	5	270	3.3	303	74	40	619
NKE0505XDC	5	289	5	200	69	28	2414
NKE0505XDEC	5	250	5	200	77	34	419
NKE0509XDC	5	266	9	111	75	29	1173
NKE0512XDC	5	260	12	83	78	30	633
NKE0515XDC	5	256	15	66	78	32	360
NKE0503XSC	5	270	3.3	200	74	40	619
NKE0505XSC	5	289	5	303	69	28	2414
NKE0505XSEC	5	250	5	200	77	34	419
NKE0509XSC	5	266	9	111	75	29	1173
NKE0512XSC	5	260	12	83	78	30	633
NKE0515XSC	5	256	15	66	78	32	360
NKE1205XDC	12	117	5	200	72	35	620
NKE1209XDC	12	107	9	111	78	50	488
NKE1212XDC	12	105	12	83	79	57	360
NKE1215XDC	12	103	15	66	81	60	252
NKE1205XSC	12	117	5	200	72	35	620
NKE1209XSC	12	107	9	111	78	50	488
NKE1212XSC	12	105	12	83	79	57	360
NKE1215XSC	12	103	15	66	81	60	252

NKE0505XSEC/NKE0505XDEC offers higher efficiency than NKE0505XSC/NKE0505XDC but over a narrower operating temperature range.

Input Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 3.3V	2.97	3.3	3.63	V
	Continuous operation, 5V	4.5	5.0	5.5	
	Continuous operation, 12V	10.8	12.0	13.2	
Reflected ripple current	3.3V input types		40	60	mA p-p

Absolute Maximum Ratings

Lead temperature 1.5mm from case for 10 seconds	300°C
Internal power dissipation	530mW
Input voltage V, NKE03 types	5.5V
Input voltage V, NKE05 types	7V
Input voltage V, NKE12 types	15V

Output Specifications					
Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	TA=-40°C to 120°C, see derating graphs	0.1		1.0	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High Vin to low Vin		1.0	1.2	%%
Load regulation ¹	10% load to rated load, 3.3V output types & 0309		10	1.2	%
	10% load to rated load, 5V output types		12.8	15	
	10% load to rated load, 9V output types		7.5	10	
	10% load to rated load, 12V output types		6.5	9.5	
	10% load to rated load, 15V output types		6.0	8.5	
Ripple & Noise	BW=DC to 20MHz, 3.3V output types, &0305, 0505XSEC, 0505XDEC		40	80	mV p-p
	BW=DC to 20MHz, other 5V output types		62	85	
	BW=DC to 20MHz, 9V output types		103	170	
	BW=DC to 20MHz, 12V output types		49	75	
	BW=DC to 20MHz, 15V output types		39	65	

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	All output types		115		kHz

Temperature Characteristics					
Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		130	
Case temperature rise above ambient	0505, 1205			41	
	All other output types			32	
Cooling	Free air convection				

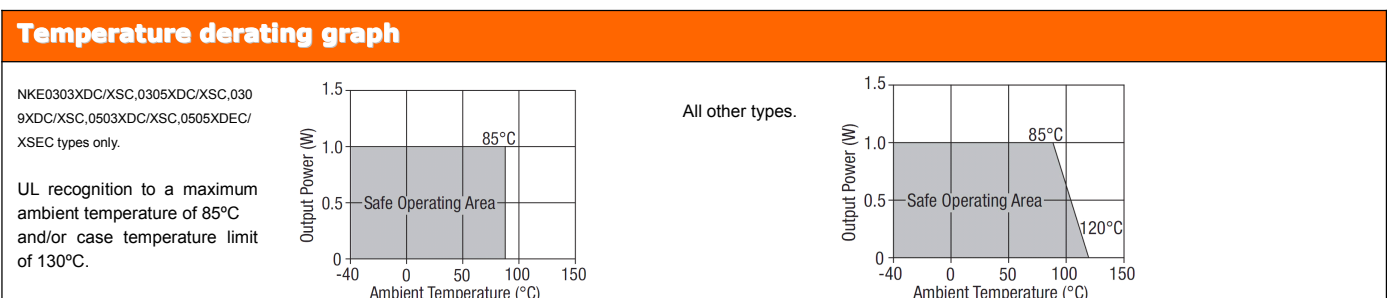
Technical notes

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. MICRODC Power Module NKE series of dc/dc converters are all 100% production tested at their stated isolation voltage. This is 1000V DC for 1 second. A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?" The NKE series has been recognized by Underwriters Laboratory for functional insulation. 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. While manufactured parts can 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.

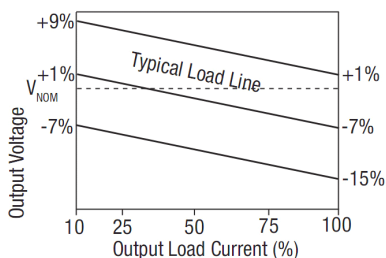
Safety Approval

The NKE series has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum ambient temperature of 85°C and/or case temperature limit of 130°C. Case temperature measured on the face opposite the pins.

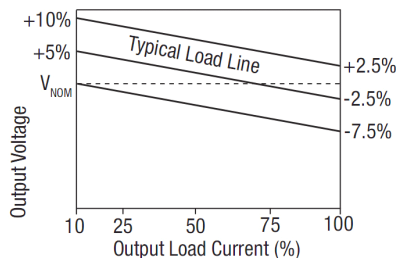


Tolerance envelopes

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

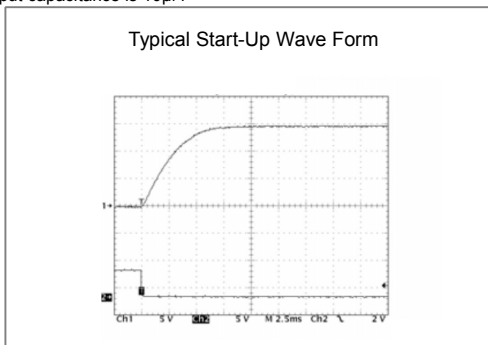
Minimum load

The minimum load to meet data sheet 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 2.2 μ s and output capacitance of 10 μ F, are shown in the table below. The product series will start into a capacitance of 47 μ F with an increased start time, however, the maximum recommended output capacitance is 10 μ F.

	Start-up time		Start-up time
	μ s		μ s
NKE0303XSC	544	NKE0512XSC	5040
NKE0305XSC	1306	NKE0515XSC	9940
NKE0309XSC	5250	NKE1205XSC	1671
NKE0503XSC	496	NKE1209XSC	2835
NKE0505XSC	1075	NKE1212XSC	5295
NKE0505XSEC	894	NKE1215XSC	8475
NKE0509XSC	3140		



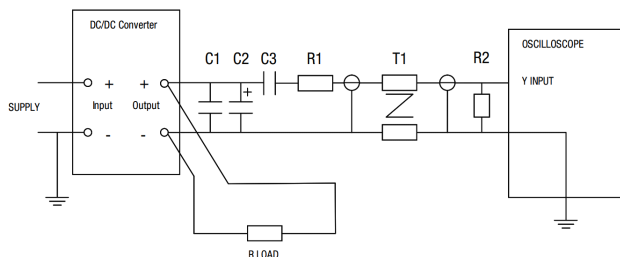
Ripple & Noise Characterization Method

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

C1	1 μ F X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter
C2	10 μ 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 Ω at 100 kHz.
C3	100nF multilayer ceramic capacitor, general purpose
R1	450 Ω resistor, carbon film, \pm 1% tolerance
R2	50 Ω 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

Output Ripple Reduction

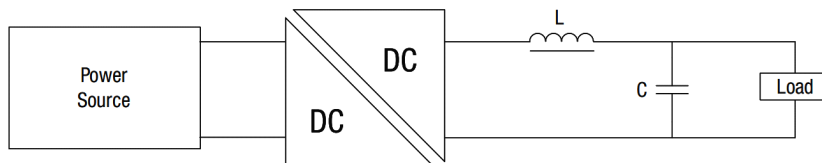
By using the values of inductance and capacitance stated, the output ripple at the rated load is lowered to 5mV p-p max.

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.

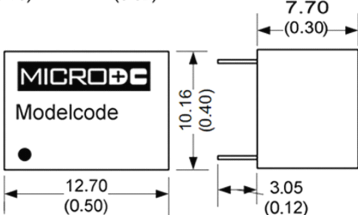
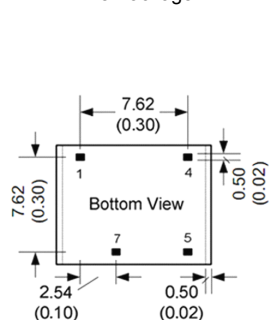


	Inductor			Capacitor
	L, μ H	SMD	Through Hole	C, μ F
NKE0303XS(D)C	10	82103C	11R103C	4.7
NKE0305XS(D)C	47	82473C	11R473C	4.7
NKE0309XS(D)C	47	82473C	11R473C	1
NKE0503XS(D)C	10	82103C	11R103C	4.7
NKE0505XS(D)C	47	82473C	11R473C	4.7
NKE0505X(S)DEC	47	82473C	11R473C	4.7
NKE0509XSC	47	82473C	11R473C	1
NKE0512XS(D)C	68	82683C	11R683C	0.68
NKE0515XS(D)C	100	82104C	11R104C	2.2
NKE1205XS(D)C	47	82473C	11R473C	4.7
NKE1209XS(D)C	47	82473C	11R473C	1
NKE1212XS(D)C	68	82683C	11R683C	0.47
NKE1215XS(D)C	100	82104C	11R104C	2.2

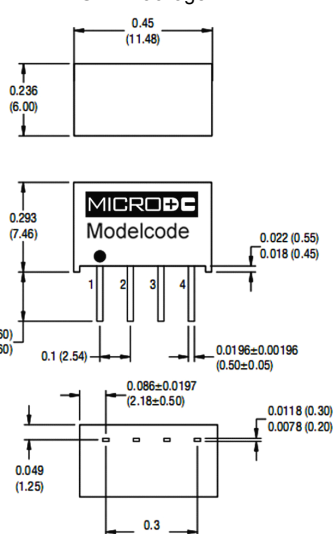
Package Specifications

Mechanical Dimensions

DIP8 Package



SIP4 Package



All dimensions in inches ± 0.01 (mm ± 0.25 mm). All pins on a 0.1 (2.54) pitch and within ± 0.01 (0.25) of true position. Weight: 1.09g (SIP4) 1.25g (DIP8)

PIN CONNECTIONS-8 PIN DIP

Pin	Function
1	-VIN
4	+VIN
5	+VOUT
7	-VOUT

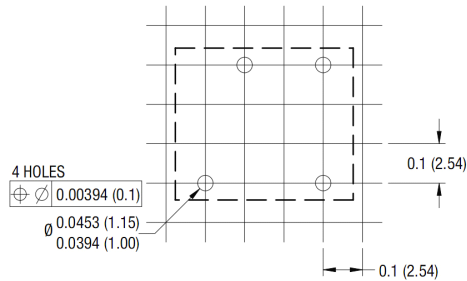
PIN CONNECTIONS-4 PIN SIP

Pin	Function
1	-VIN
2	+VIN
3	-VOUT
4	+VOUT

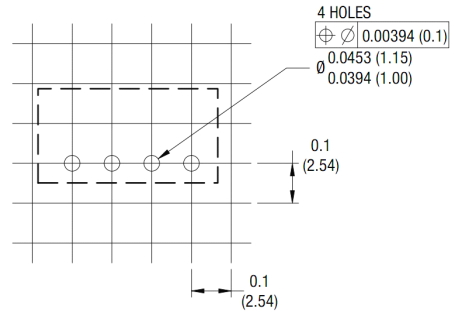
Package Specifications(continued)

Recommended Footprint Details

8 Pin DIP Package

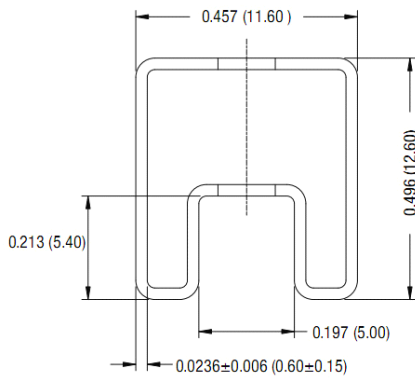


4 Pin SIP Package

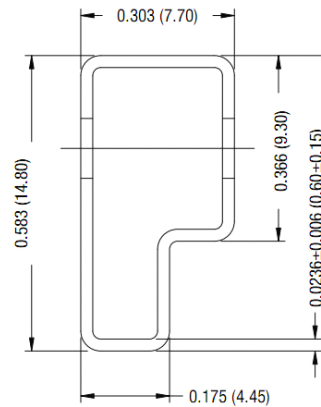


Tube Outline Dimensions

8 Pin DIP Tube



4 Pin SIP Tube



Unless otherwise stated all dimensions in inches (mm) ± 0.5 mm.

Tube length (8 Pin DIP) : 20.47 (520mm ± 2 mm).

Tube length (4 Pin SIP) : 20.67 (525mm ± 2 mm).

PRODUCT ID DESCRIPTION

