Murata Power Solutions

NMV1 Series

3kVDC Isolated 1W Single Output DC-DC Converters

FEATURES

- Operation up to 115°C (with derating)
- Single output
- UL62368-1 recognised
- Industry standard pinout
- 3kVDC isolation 'Hi-Pot Test'
- Internal SMD construction
- No external components required
- MTTF up to 4.2 million hours
- No electrolytic or tantalum capacitors
- Pin compatible with MEV1, MEV3, NMK & NMV series

PRODUCT OVERVIEW

The NMV1 series of extended industrial temperature range DC-DC converters are the standard buliding blocks for on-board distributed power systems. They are ideally suited for providing local supplies on control system boards with the added benefit of 3kVDC galvanic isolation to reduce switching noise.

SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Load Regulation		Ripple & Noise		Efficiency (Min)	Efficiency (Typ)	Isolation Capacitance	MTTF[1]	
	V	V	mA	mA	%		mVp-p		%		pF	MIL.	Tel.
					Typ.	Max.	Typ.	Max.				kHrs	
NMV1S0505SC	5	5	200	275	11	14	15	30	67	72	15	4270	66604

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation	4.5	5	5.5	V
Reflected ripple current			5		mA p-p

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency			120		kHz

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 105°C, see derating graph			1	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN}		1.1	1.2	%/%

ISOLATION CHARACTERISTICS

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

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	See safety approval section for UL temperature specification	-40		115	°C
Storage		-50		125	
Case Temperature above ambient				28	
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS

Input voltage V_{IN}, NMV1S0505SC	7V
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.

RoHS COMPLIANT

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

1. Calculated using MIL-HDBK-217 and Telcordia SR-332 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.

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 NMV1 series of DC-DC converters are all 100% production tested at their stated isolation voltage. This is 3kVDC for 1 second.

A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?"

The NMV1 series is recognised 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. The NMV1 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.

SAFETY APPROVAL

UL62368-1

The NMV1 series is recognised by Underwriters Laboratory (UL) to UL62368-1 for functional insulation with a case temperature limit of 105ºC.

FUSING

The NMV1 series is not internally fused so to meet the requirements of UL62368-1 an anti-surge input line fuse should always be used with ratings as defined below.

NMV1S0505SC: 0.5A.

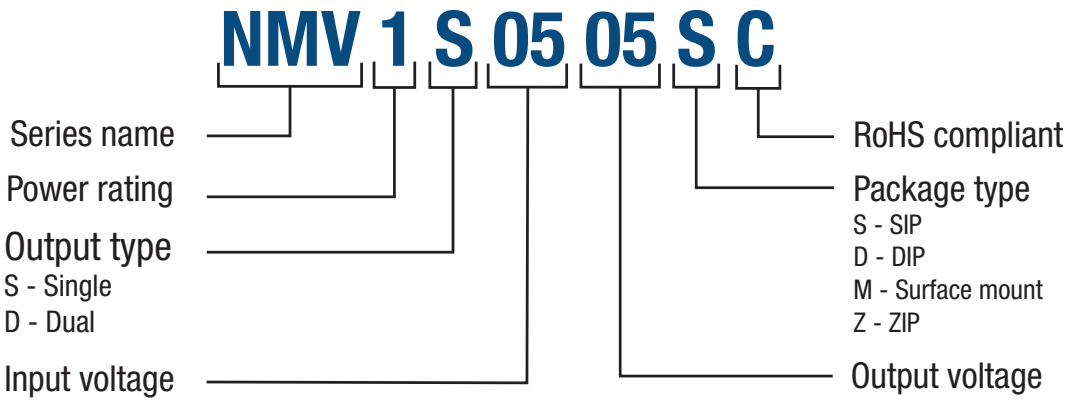
All fuses should be UL recognised and rated to 125V.
File number E151252 applies.

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 this product series is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. This series is backward compatible with Sn/Pb soldering systems. For further information, please visit https://www.murata.com/en-global/products/power/rohs

PART NUMBER STRUCTURE



ENVIRONMENTAL VALIDATION TESTING

The following tests have been conducted on this product series, please contact Murata if further information about the tests is required.

Test	Standard	Condition
Temperature cycling	JEDEC JESD22-A104	200 cycles in a dual zone chamber from -40 (+5/-10)°C to 105 (+10/-5)°C. 15 mins dwell at each (inclusive of ramps). 2 cycles per hour.
Humidity	JEDEC JESD22-A101	Run powered samples at 85°C±2°C/85 ±5% RH for 1000 (-24/+168) hours.
Storage life (high temperature)	JEDEC JESD22-A103, Condition A	125°C +10/-0°C for ≥1000 hours.
Solderability	EIA/IPC/JEDEC J-STD-002	SnPb (Test A) For leaded solderability the parts are conditioned in a steam ager for 8 hours ±15 min. at a temperature of 93°C±3°C. Dipped in solder at 245°C ±5°C for 5 (+0/-0.5) seconds. Pb-free (Test A1) For lead free solderability the parts are conditioned in a steam ager for 8 hours ±15 min. at a temperature of 93°C±3°C. Dipped in solder at 255°C ±5°C for 5 (+0/-0.5) seconds.
Solder heat	JEDEC JESD22-B106	The test sample is subjected to a molten solder bath at 270°C ±5°C for 7 (+2/-0) seconds (96SC tin/silver/copper).
Hand solder heat	MIL-STD-202 Method 210, Test Condition A	The soldering iron is heated to 350°C ±10°C and applied to the terminations for a duration of 4 to 5 seconds.
Shock	BS EN 61373	Test is 30ms duration, 3 shocks in each sense of 3 mutually perpendicular axes (18 shocks total). Level at each axis: Vertical, Traverse and Longitudinal: 50m/s2. Device is secured via the pins.
Vibration	BS EN 61373 with respect to BS EN 60068-2-64	5 – 150Hz. Level at each axis – Vertical, Traverse and Longitudinal: 5.72m/s2 rms. 5 hours in each axis. Device is secured via the pins.
Solvent resistance	MIL-STD-883, Method 2015	Separate samples subjected to IPA.
Solvent cleaning	Resistance to cleaning agents	Solvent – Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion 45°C - 60°C.
ESD	JEDEC JESD22-A114	HBM at 8.0kV.
Lead integrity: pull	MIL-STD 883 Method 2004 Test Condition A	A pull of 0.227kg applied for 30 seconds. The force is then increased until the pins snap.
Lead integrity: fatigue	MIL-STD 883 Method 2004 Test condition B_2	The leads are bent to an angle of 15º. Each lead is subjected to 3 cycles.
Lead integrity: adhesion	MIL-STD 883 Method 2025	Leads are bent through 90º until a fracture occurs.

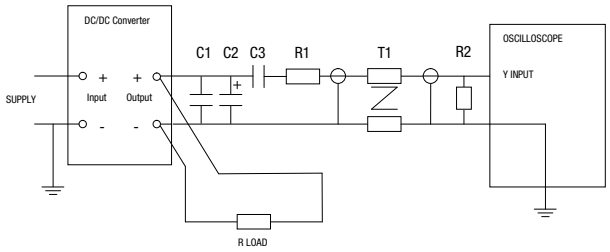
CHARACTERISATION TEST METHODS

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 100kHz
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

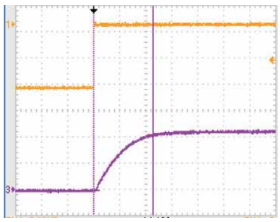
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

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
NMV1S0505SC	300

Typical Start-Up Wave Form



APPLICATION NOTES (Continued)

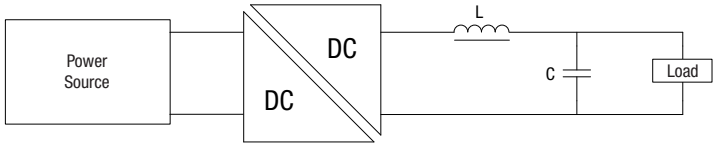
Output Ripple Reduction

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 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.

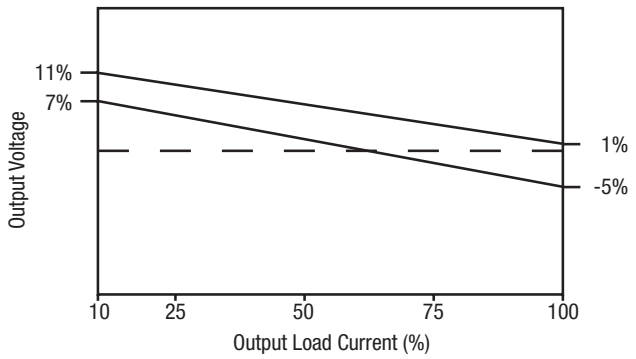


	Inductor		Capacitor	
	L, µH	Through Hole	C, µF	SMD
NMV1S0505SC	47	11R473C	4.7	GRM21BC71H475KE11L

TOLERANCE ENVELOPE

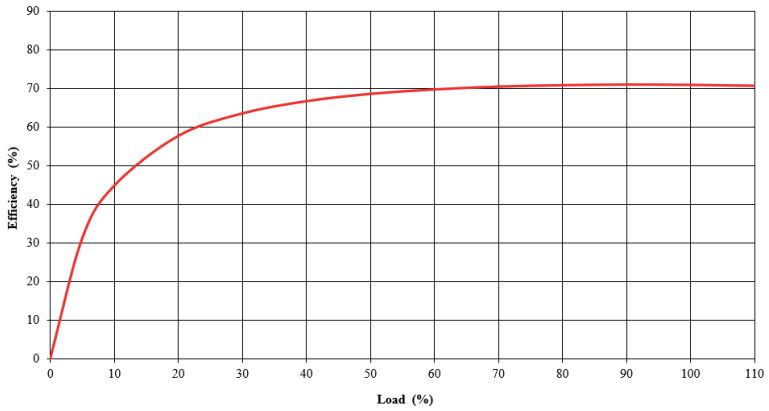
The voltage tolerance envelope shows typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to changes in output loading.

NMV1S0505SC

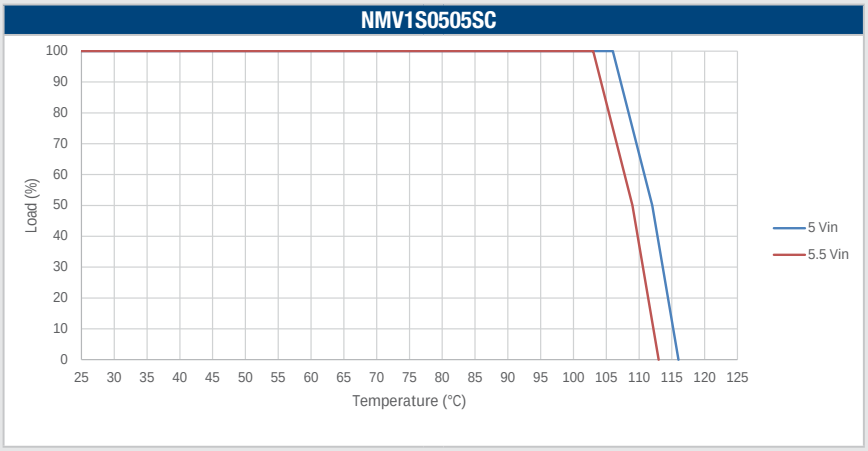


EFFICIENCY VS LOAD

NMV1S0505SC



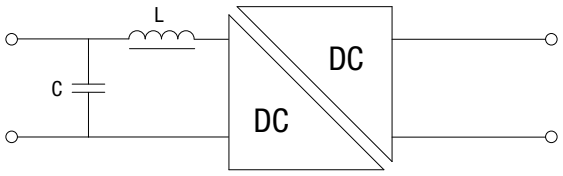
TEMPERATURE DERATING



EMC FILTERING AND SPECTRA

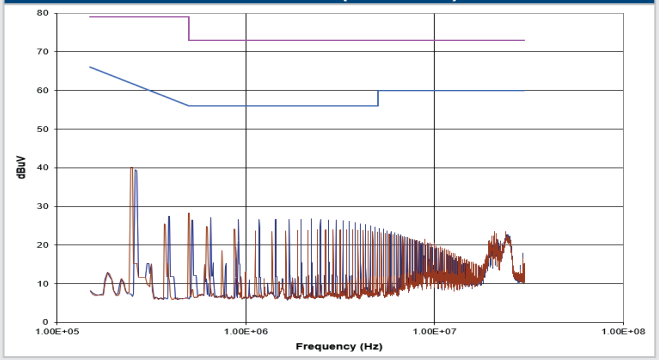
FILTERING

The following filter circuit and filter table shows the input filters typically required to meet conducted emissions limits for EN 55022 curve B using Quasi-Peak and average detectors according to CISPR 22.

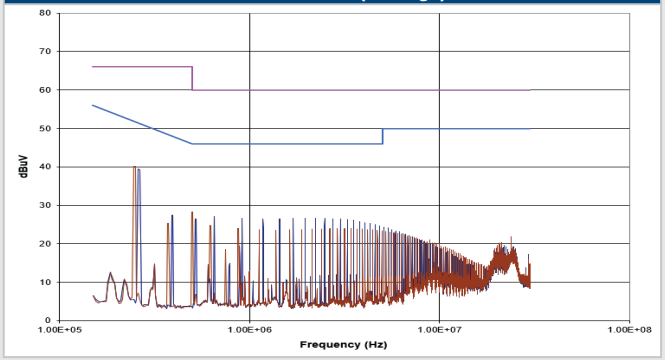


	Inductor		Capacitor	
Part Number	L, µH	SMD	C, µF	SMD
NMV1S0505SC	10	23100C	2.2	GRM188C71E225KE11D

NMV1S0505SC (Quasi-Peak)

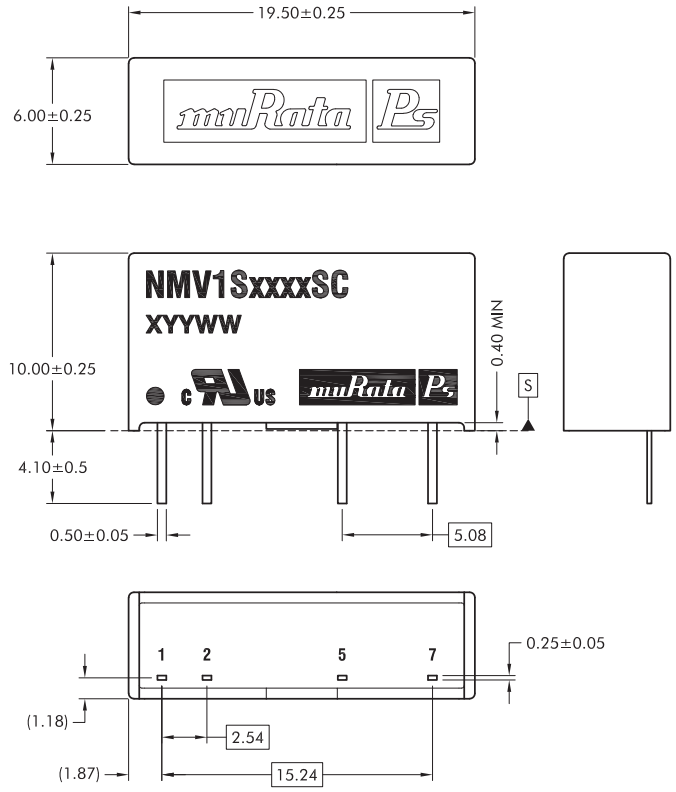


NMV1S0505SC (Average)



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



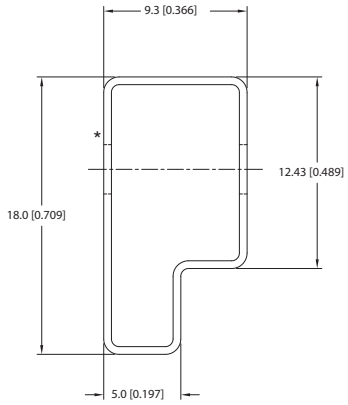
All dimensions in mm. Controlling dimension is mm.
All pins on a 2.54 pitch and within ±0.1 of true position from pin 1 at seating plane 'S'

Weight: 1.90g

PIN CONNECTIONS

7 Pin SIP	
Pin	Function
1	$+V_{IN}$
2	$-V_{IN}$
5	$-V_{OUT}$
7	$+V_{OUT}$

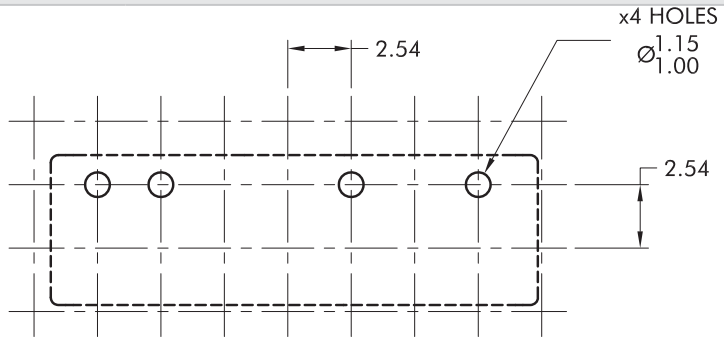
TUBE OUTLINE DIMENSIONS



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022]. Tube Length: 520mm [20.472] ±2.0 [0.079].

Tube quantity: 25

RECOMMENDED FOOTPRINT DETAILS



All dimensions in mm. Controlling dimension is mm.

DISCLAIMER

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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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