

FEATURES

- Short circuit protection option
- UL 60950 recognised
- 1kVDC isolation 'Hi Pot Test'
- Wide temperature performance at full 1 watt load, -40°C to 85°C
- Industry standard pinout
- 5V, 12V & 24V inputs
- 5V, 12V & 15V outputs
- Fully encapsulated with toroidal magnetics
- Custom solutions available
- No electrolytic or tantalum capacitors

DESCRIPTION

The NMR 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 single rail supplies on primarily digital boards with the added benefit of galvanic isolation to reduce switching noise. Surface mount technology and advanced packaging materials produce rugged reliable performance over an extended temperature range from -40°C to 85°C. For the NMR100PC protection is continuous and auto-resetting on removal of the short circuit.

SELECTION GUIDE

| Order Code | Nominal Input Voltage V | Output Voltage V | Output Current mA | Input Current at Rated Load mA | Load Regulation | | Ripple & Noise ³ | | Efficiency (Min) | | Isolation Capacitance pF | MTTF ¹ | | Recommended Alternative | |
|--|----------------------------|---------------------|----------------------|-----------------------------------|-----------------|------|-----------------------------|------|------------------|------|-----------------------------|-------------------|-------|-------------------------|--|
| | | | | | % | | mV p-p | | % | | | MIL. | Tel. | | |
| | | | | | Typ. | Max. | Typ. | Max. | Typ. | Max. | | kHrs | | | |
| | Recommended | | | | | | | | | | | | | | |
| | In Production | | | | | | | | | | | | | | |
| NMR100C | 5 | 5 | 200 | 290 | 12 | 14 | 6 | 10 | 69 | 28 | 1847 | | | | |
| NMR101C | 5 | 12 | 83 | 260 | 6.9 | 7.7 | 4.6 | 10 | 77 | 33 | 981 | | | | |
| NMR102C | 5 | 15 | 67 | 253 | 6.5 | 7.5 | 4.3 | 10 | 79 | 40 | 667 | | | | |
| NMR106C | 12 | 5 | 200 | 121 | 12.5 | 13.4 | 5.3 | 10 | 69 | 36 | 1485 | | | | |
| NMR107C | 12 | 12 | 83 | 110 | 6.9 | 7.7 | 5 | 10 | 76 | 58 | 869 | | | | |
| NMR118C | 24 | 5 | 200 | 60 | 6.8 | 10 | 8 | 15 | 70 | 61 | 1253 | | | | |
| NMR120C | 24 | 15 | 67 | 52 | 2.5 | 3.5 | 8 | 15 | 80 | 122 | 566 | | | | |
| Short Circuit Protection Option | | | | | | | | | | | | | | | |
| NMR100PC | 5 | 5 | 200 | 255 | 10 | 12 | 10 | 25 | 74 | 76.5 | 22 | 3095 | 61060 | | |
| To be discontinued | | | | | | | | | | | | | | | |
| NMR108C | 12 | 15 | 67 | 110 | 6.5 | 7.5 | 4 | 10 | 76 | 56 | 613 | | | MER1S1215SC | |
| NMR119C | 24 | 12 | 83 | 53 | 2.8 | 4 | 7 | 15 | 78 | 98 | 784 | | | MER1S2412SC | |
| Discontinued | | | | | | | | | | | | | | | |
| NMR112C | 15 | 5 | 200 | 93 | 8.1 | 10 | 14 | 20 | 69 | 27 | 2110 | | | MER1S1505SC | |
| NMR113C | 15 | 12 | 83 | 85 | 3.3 | 4 | 12 | 15 | 77 | 58 | 1790 | | | Contact Murata | |
| NMR114C | 15 | 15 | 67 | 84 | 2.8 | 3.5 | 14 | 20 | 78 | 67 | 1560 | | | MER1S1515SC | |

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 | |
| | Continuous operation, 24V input types | 21.6 | 24 | 26.4 | |
| Input short circuit current | Short circuit variants | | 95 | | mA |
| Input reflected ripple current | Short circuit types | | 2 | 15 | mA p-p |
| | 5V & 12V input types | | 1.6 | 2 | |
| | 15V & 24V input types | | 5 | 10 | |

OUTPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|----------------------------|--|------|------|------|-------|
| Rated Power ² | T _A =-40°C to 85°C, See derating graph | | | 1.0 | W |
| Voltage Set Point Accuracy | See tolerance envelope | | | | |
| Line regulation | High V _{IN} to low V _{IN} ; Short circuit types | | 1.15 | 1.2 | %/% |
| | High V _{IN} to low V _{IN} ; All other output types | | 1.0 | 1.2 | |

ISOLATION CHARACTERISTICS

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



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



1. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
2. See derating graph.
3. See ripple & noise characterisation method.
All specifications typical at T_A=25°C, nominal input voltage and rated output current unless otherwise specified.

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} , NMR100C, NMR101C, NMR102C | 7V |
| Input voltage V_{IN} , NMR106C, NMR107C, NMR108C | 15V |
| Input voltage V_{IN} , NMR112C, NMR113C, NMR114C | 18V |
| Input voltage V_{IN} , NMR118C, NMR119C, NMR120C | 28V |

GENERAL CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---------------------|---------------------|------|------|------|-------|
| Switching frequency | 5V input types | | 110 | | kHz |
| | 12V input types | | 160 | | |
| | 15V input types | | 90 | | |
| | 24V input types | | 80 | | |
| | Short circuit types | | 97 | | |

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 | | 33 | | |
| | All other output types | | 28 | | |
| | Short circuit types | | 18 | | |
| 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 NMR 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?"

The NMR 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 NMR 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

UL60950

The NMR series is recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum still air ambient temperature of 100°C as measured at any point on the case of the unit (hotspot).

FUSING

The NMR Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.

- Input Voltage, 5V 0.5A
- Input Voltage, 12V 0.25A
- Input Voltage, 24V 0.12A

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

RoHS COMPLIANCE INFORMATION



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. The series is backward compatible with Sn/Pb soldering systems.
For further information, please visit www.murata-ps.com/rohs

CHARACTERISATION TEST METHODS

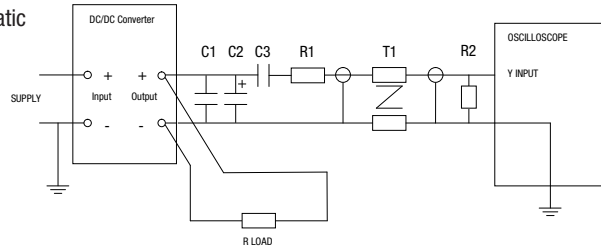
Ripple & Noise Characterisation Method

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

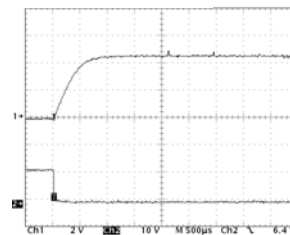
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

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 | | Start-up time µs |
|---------|---------------------|----------|---------------------|
| NMR100C | 2301 | NMR112C | 744 |
| NMR101C | 5570 | NMR113C | 1908 |
| NMR102C | 8289 | NMR114C | 6620 |
| NMR106C | 783 | NMR118C | 671 |
| NMR107C | 4770 | NMR119C | 5335 |
| NMR108C | 4850 | NMR120C | 6370 |
| | | NMR100PC | 360 |

Typical Start-Up Wave Form



APPLICATION NOTES (Continued)

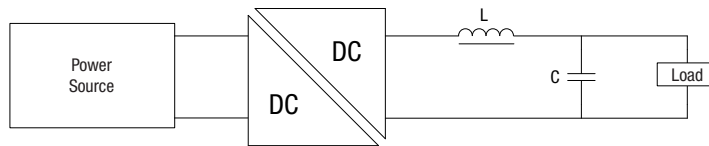
Output Ripple Reduction

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.

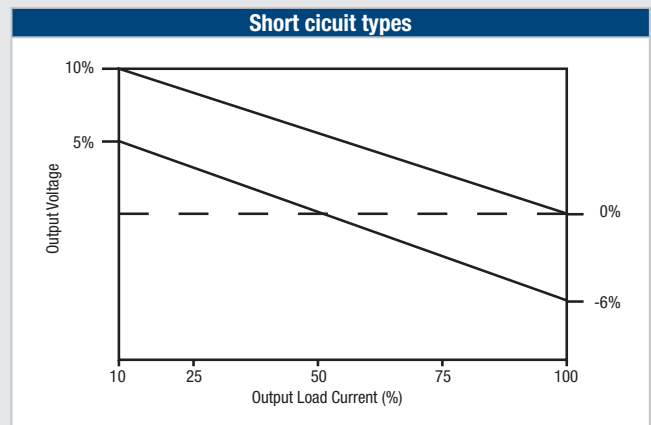
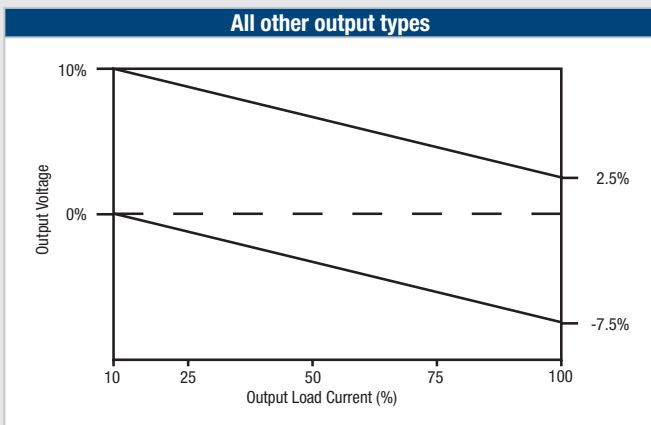
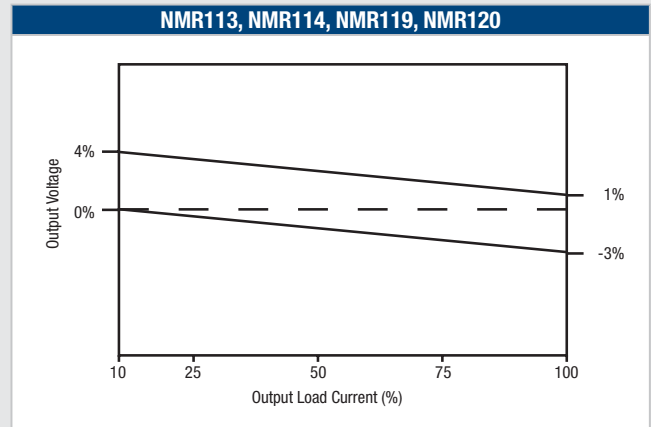
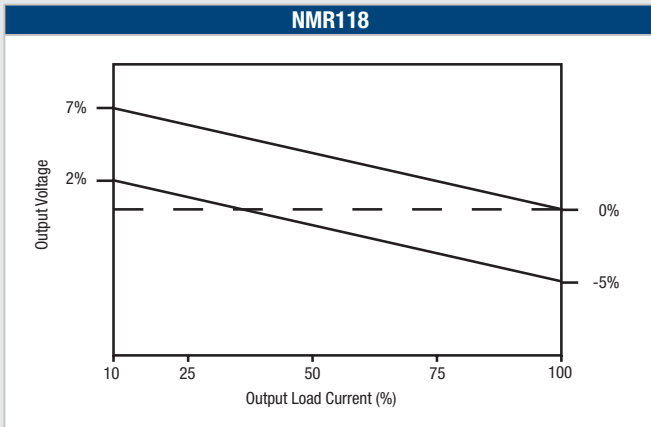
Inductor: The rated current of the inductor should not be less than that of the output of the DC-DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC-DC converter. The SRF (Self Resonant Frequency)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



| | Inductor | | | Capacitor |
|----------|------------|--------|--------------|------------|
| | L, μ H | SMD | Through Hole | C, μ F |
| NMR100C | 10 | 82103C | 11R103C | 4.7 |
| NMR101C | 47 | 82473C | 11R473C | 1 |
| NMR102C | 47 | 82473C | 11R473C | 1 |
| NMR106C | 10 | 82103C | 11R103C | 4.7 |
| NMR107C | 47 | 82473C | 11R473C | 1 |
| NMR108C | 47 | 82473C | 11R473C | 1 |
| NMR112C | 10 | 82103C | 11R103C | 4.7 |
| NMR113C | 47 | 82473C | 11R473C | 1 |
| NMR114C | 47 | 82473C | 11R473C | 1 |
| NMR118C | 10 | 82103C | 11R103C | 4.7 |
| NMR119C | 47 | 82473C | 11R473C | 1 |
| NMR120C | 47 | 82473C | 11R473C | 1 |
| NMR100PC | 22 | 82223C | 11R223C | 1 |

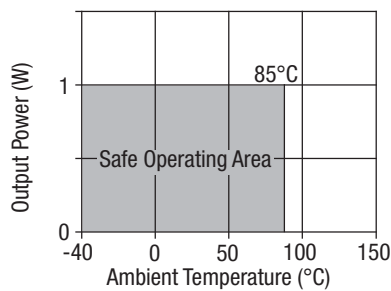
TOLERANCE ENVELOPES

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

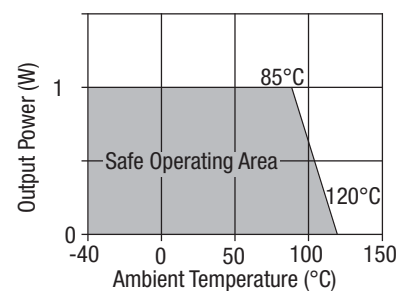


TEMPERATURE DERATING GRAPHS

Short Circuit types.



All other types.



EFFICIENCY VS LOAD

NMR100C

NMR101C

NMR102

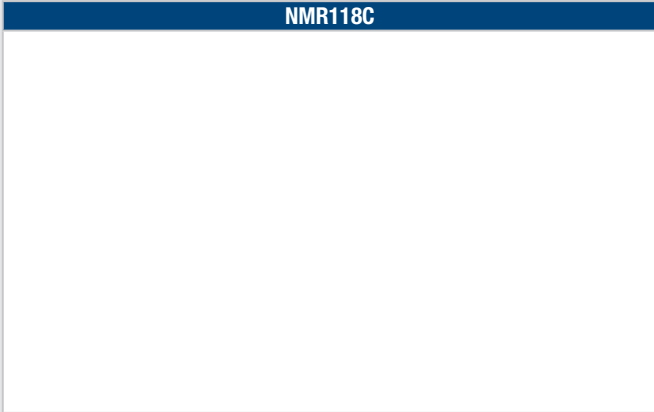
NMR106C

NMR107C

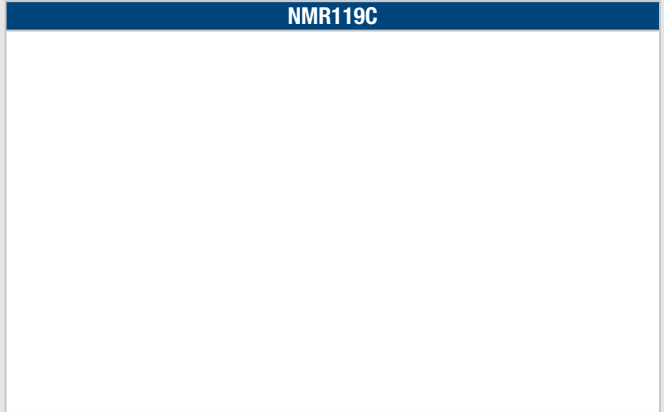
NMR108C

EFFICIENCY VS LOAD (Continued)

NMR118C



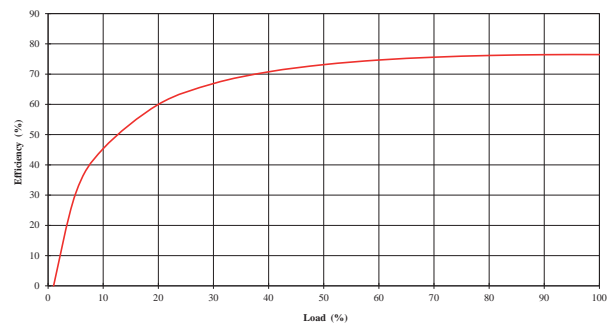
NMR119C



NMR120C



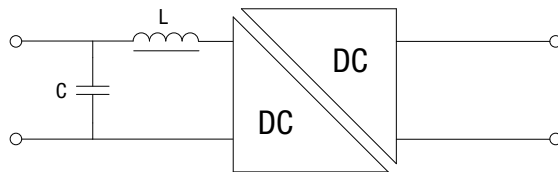
NMR100PC



EMC FILTERING AND SPECTRA

FILTERING

The following filter circuit and filter table shows the input filters typically required to meet EN 55022 Curve B, Quasi-Peak EMC limit, as shown in the following plots. The following plots show positive and negative quasi peak and CISPR22 Average Limit B (pink line) and Quasi Peak Limit B (green line) adherence limits.



C Ceramic capacitor

| Part Number | Inductor | | | Capacitor |
|-----------------|------------|--------|--------------|------------|
| | L, μ H | SMD | Through Hole | C, μ F |
| NMR100C | | | | |
| NMR101C | | | | |
| NMR102C | | | | |
| NMR106C | | | | |
| NMR107C | | | | |
| NMR108C | | | | |
| NMR118C | | | | |
| NMR119C | | | | |
| NMR120C | | | | |
| NMR100PC | 10 | 82103C | 13R103C | 10 |

NMR100C

NMR101C

NMR102C

NMR106C

EMC FILTERING AND SPECTRA (Continued)

NMR107C



NMR108C



NMR118C



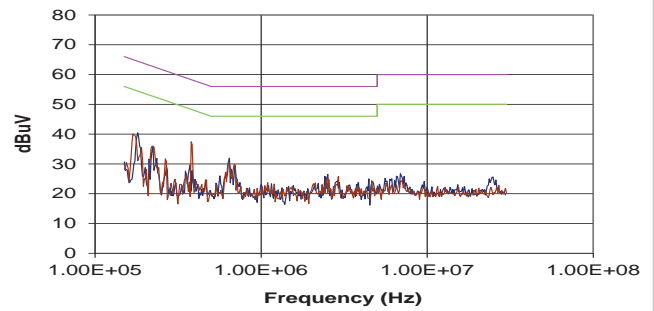
NMR119C



NMR120C



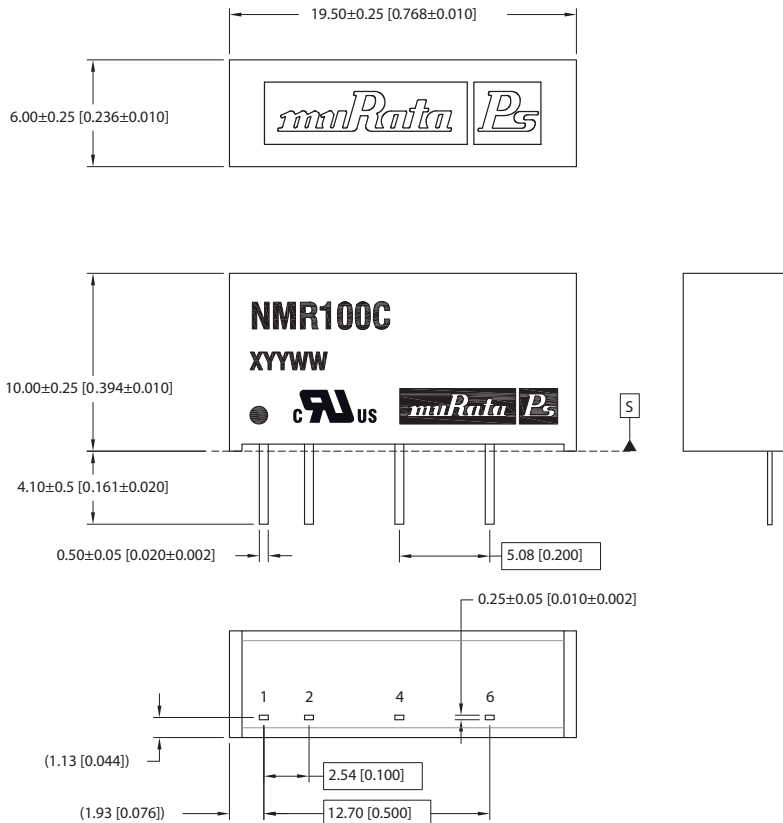
NMR100PC



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

7 Pin SIP Package



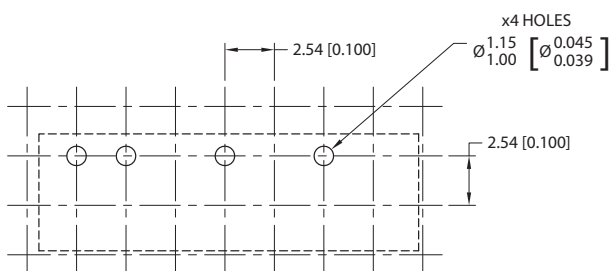
All dimensions in mm (inches) Controlling dimension is mm.
 All pins on a 2.54 (0.100) pitch and within ±0.1 (0.004) of true position from pin 1 at seating plane 'S'
 For SIP products, from date code D2224 onwards, products have an embossed logo on the top of the case.
 Prior to this date, SIP products have flat surface finish.

Weight: 2.1g (C) 1.9g (PC)

PIN CONNECTIONS - 7 PIN SIP

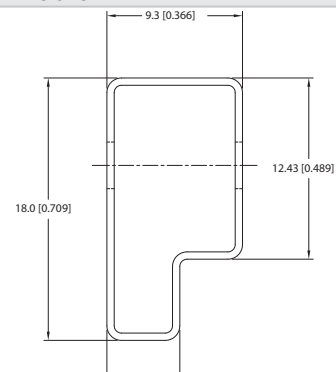
| Pin | Function |
|-----|----------|
| 1 | +VIN |
| 2 | -VIN |
| 4 | -VOUT |
| 6 | +VOUT |

RECOMMENDED FOOTPRINT DETAILS



All dimensions in mm (inches) Controlling dimension is mm.

TUBE OUTLINE DIMENSIONS



Tube quantity: 35

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

DISCLAIMER

Unless otherwise stated in the datasheet, all products are designed for standard commercial and industrial applications and NOT for safety-critical and/or life-critical applications.

Particularly for safety-critical and/or life-critical applications, i.e. applications that may directly endanger or cause the loss of life, inflict bodily harm and/or loss or severe damage to equipment/property, and severely harm the environment, a prior explicit written approval from Murata is strictly required. Any use of Murata standard products for any safety-critical, life-critical or any related applications without any prior explicit written approval from Murata shall be deemed unauthorised use.

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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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Refer to: <https://www.murata.com/en-eu/products/power/requirements>

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