

FEATURES

- Short circuit protection options
- UL 60950 recognised
- Single isolated output
- 1kVDC isolation 'Hi Pot Test'
- Wide temperature performance at full 1 watt load, -40°C to 85°C^2
- Industry standard pinout
- 5V, 12V, 15V & 24V input
- 5V, 9V, 12V and 15V output
- Fully encapsulated with toroidal magnetics
- No external components required
- Pin compatible with CME, CRE1, CRL2, LME, MEE1, MEE3, NKE & NML

DESCRIPTION

The NME series of DC-DC Converters is particularly suited to isolating and/or converting DC power rails. 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 . For lower ripple, refer to output ripple reduction section. The NME series offers short circuit protection options (PC) across the operating temperature range. Short circuits of less than 1Ω cause the converter to enter a 'foldback' limiting mode such that the input current is approximately 95mA for 0505 variant. Protection is continuous and auto-resetting on removal of the short circuit.



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



NME Series

Isolated 1W Single Output DC-DC Converters

SELECTION GUIDE

| Order Code | Nominal Input Voltage | Output Voltage | Output Current | Input Current at Rated Load | Load Regulation ² | | Ripple & Noise | | Efficiency (Min) | Efficiency (Typ) | Isolation Capacitance | MTTF ¹ | | Package Style | | | | | | | | | | | | | | | |
|----------------------------------|-----------------------|----------------|----------------|-----------------------------|------------------------------|------|----------------|------|------------------|------------------|-----------------------|-------------------|-------|-------------------------|---------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | V | V | mA | mA | % | | mV p-p | | % | | pF | MIL. | Tel. | | | | | | | | | | | | | | | | |
| | | | | | Typ. | Max. | Typ. | Max. | | | | kHrs | | | | | | | | | | | | | | | | | |
| Recommended | | | | | | | | | | | | | | | In Production | | | | | | | | | | | | | | |
| NME0505DC | 5 | 5 | 200 | 286 | 12 | 14 | 16 | 40 | | 69 | 30 | 3415 | | DIP | | | | | | | | | | | | | | | |
| NME0509DC | 5 | 9 | 111 | 260 | 8 | 9 | 60 | 75 | | 77 | 37 | 3078 | | | | | | | | | | | | | | | | | |
| NME0512DC | 5 | 12 | 83 | 256 | 6.5 | 7.5 | 50 | 65 | | 78 | 33 | 2205 | | | | | | | | | | | | | | | | | |
| NME0515DC | 5 | 15 | 67 | 250 | 6 | 7.5 | 10 | 25 | | 80 | 40 | 1532 | | | | | | | | | | | | | | | | | |
| NME0524DC | 5 | 24 | 42 | 248 | 5.5 | 7.5 | 140 | 180 | | 80 | 48 | | | | | | | | | | | | | | | | | | |
| NME0505SC | 5 | 5 | 200 | 286 | 12 | 14 | 16 | 40 | | 69 | 30 | 3415 | | SIP | | | | | | | | | | | | | | | |
| NME0509SC | 5 | 9 | 111 | 260 | 8 | 9 | 60 | 75 | | 77 | 37 | 3078 | | | | | | | | | | | | | | | | | |
| NME0512SC | 5 | 12 | 83 | 256 | 6.5 | 7.5 | 50 | 65 | | 78 | 33 | 2205 | | | | | | | | | | | | | | | | | |
| NME0515SC | 5 | 15 | 67 | 250 | 6 | 7.5 | 10 | 25 | | 80 | 40 | 1532 | | | | | | | | | | | | | | | | | |
| NME0524SC | 5 | 24 | 42 | 248 | 5.5 | 7.5 | 140 | 180 | | 80 | 48 | | | | | | | | | | | | | | | | | | |
| NME1205DC | 12 | 5 | 200 | 117 | 8 | 10 | 12 | 30 | | 69 | 33 | 2493 | | DIP | | | | | | | | | | | | | | | |
| NME1212DC | 12 | 12 | 83 | 104 | 4 | 5 | 8 | 20 | | 76 | 55 | 1780 | | | | | | | | | | | | | | | | | |
| NME1215DC | 12 | 15 | 67 | 110 | 3 | 4 | 40 | 55 | | 75 | 52 | 1313 | | | | | | | | | | | | | | | | | |
| NME1205SC | 12 | 5 | 200 | 117 | 8 | 10 | 12 | 30 | | 69 | 33 | 2493 | | SIP | | | | | | | | | | | | | | | |
| NME1209SC | 12 | 9 | 111 | 115 | 5 | 5.5 | 60 | 75 | | 74 | 48 | 2311 | | | | | | | | | | | | | | | | | |
| NME1212SC | 12 | 12 | 83 | 104 | 4 | 5 | 50 | 65 | | 76 | 55 | 1780 | | | | | | | | | | | | | | | | | |
| NME1215SC | 12 | 15 | 67 | 111 | 3 | 4 | 40 | 55 | | 75 | 52 | 1313 | | | | | | | | | | | | | | | | | |
| NME1515SC | 15 | 15 | 67 | 81 | 2.5 | 3 | | 150 | | 82 | | | | | | | | | | | | | | | | | | | |
| NME2405DC | 24 | 5 | 200 | 58 | 8.5 | 10 | | 150 | | 70 | 40 | 201 | | DIP | | | | | | | | | | | | | | | |
| NME2412DC | 24 | 12 | 83 | 52 | 3 | 4 | | 150 | | 80 | 78 | 163 | | | | | | | | | | | | | | | | | |
| NME2415DC | 24 | 15 | 67 | 51 | 2.5 | 3 | | 150 | | 80 | 79 | 136 | | | | | | | | | | | | | | | | | |
| NME2405SC | 24 | 5 | 200 | 58 | 8.5 | 10 | | 150 | | 70 | 40 | 201 | | SIP | | | | | | | | | | | | | | | |
| NME2412SC | 24 | 12 | 83 | 52 | 3 | 4 | | 150 | | 80 | 78 | 163 | | | | | | | | | | | | | | | | | |
| NME2415SC | 24 | 15 | 67 | 51 | 2.5 | 3 | | 150 | | 80 | 79 | 136 | | | | | | | | | | | | | | | | | |
| Short Circuit Protection Options | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NME0505SPC | 5 | 5 | 200 | 255 | 9.5 | 12 | 11 | 25 | 75 | 77 | 22 | 2887 | 47047 | SIP | | | | | | | | | | | | | | | |
| NME0505DPC | 5 | 5 | 200 | 255 | 9.5 | 12 | 11 | 25 | 75 | 77 | 22 | 2887 | 47047 | DIP | | | | | | | | | | | | | | | |
| Discontinued | | | | | | | | | | | | | | Recommended Alternative | | | | | | | | | | | | | | | |
| NME1209DC | 12 | 9 | 111 | 115 | 5 | 5.5 | 60 | 75 | | 74 | 48 | 2311 | | DIP | MEE1S1209DC | | | | | | | | | | | | | | |
| NME2409DC | 24 | 9 | 111 | 54 | 4 | 5 | | 150 | | 75 | 59 | 185 | | | MEE1S2409DC | | | | | | | | | | | | | | |
| NME2409SC | 24 | 9 | 111 | 54 | 4 | 5 | | 150 | | 75 | 59 | 185 | | SIP | MEE1S2409SC | | | | | | | | | | | | | | |

INPUT CHARACTERISTICS

| INPUT CHARACTERISTICS | | | | | |
|--------------------------------|---------------------------------------|------|------|------|--------|
| Parameter | Conditions | Min. | Typ. | Max. | Units |
| Voltage range | Continuous operation, 5V input types | 4.5 | 5.0 | 5.5 | V |
| | Continuous operation, 12V input types | 10.8 | 12.0 | 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 variants | | 3 | 15 | mA p-p |
| | 15V input type | | | 90 | |
| | All other variants ³ | | 26 | 48 | |

1. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
 2. NME1515SC, NME24XXXC prior to date code X1635 have operating temperature range of 0 to 70°C.
 3. Excludes 24V input types.
- All specifications typical at $T_A=25^{\circ}\text{C}$, nominal input voltage and rated output current unless otherwise specified.

OUTPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|----------------------------|---|------|------|------|-------|
| Rated Power | See derating curves | | | 1.0 | W |
| Voltage Set Point Accuracy | See tolerance envelope | | | | |
| Line regulation | High V_{IN} to low V_{IN} ; All 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 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 | | 145 | | |
| | 15V input types | | 100 | | |
| | 24V input types | | 100 | | |
| | Short circuit types | | 91 | | |

TEMPERATURE CHARACTERISTICS

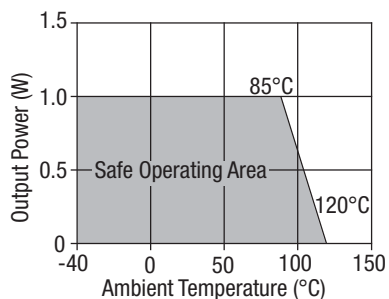
| Parameter | Conditions | Min. | Typ. | Max. | Units |
|--------------------------------|-------------------------------------|------|------|------|-------|
| Specification | All output types ¹ | -40 | | 85 | °C |
| Storage | | -50 | | 130 | |
| Case Temperature above ambient | Non-short circuit types | | | 41 | |
| | 5V output types | | | 32 | |
| | All other output types ² | | | | |
| Cooling | Short circuit types (DIP) | | 23 | | |
| | Short circuit types (SIP) | | 24 | | |
| Cooling | Free air convection | | | | |

ABSOLUTE MAXIMUM RATINGS

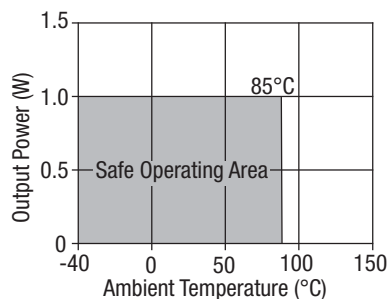
| | |
|---|-------|
| Lead temperature 1.5mm from case for 10 seconds | 260°C |
| Input voltage V_{IN} , NME05 types | 7V |
| Input voltage V_{IN} , NME12 types | 15V |
| Input voltage V_{IN} , NME15 types | 18V |
| Input voltage V_{IN} , NME24 types | 28V |

TEMPERATURE DERATING GRAPH

Non-short circuit types¹:



Short circuit types:



1. NME1515SC, NME24XXC prior to date code X1635 have operating temperature range of 0 to 70°C.

2. Excludes 24V input types.

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 NME 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 NME has been 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 NME 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

The NME 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 100°C. Case temperature measured on the face opposite the pins.

The NME Series of converters are not internally fused so to meet the requirements of UL 60950 an anti-surge input line fuse should always be used with ratings as defined below.

NME05xxx: 0.5A
NME12xxx: 0.25A
NME15xxx: 0.2A
NME24xxx: 0.12A

All fuses should be UL recognised and rated at 125V.

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. 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

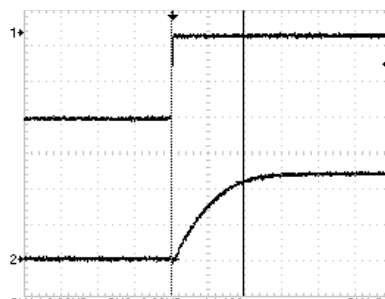
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

Capacitive loading and start up

Typical start up times for this series, with a typical input voltage rise time of 2.2 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 μ s |
|------------|--------------------------|
| NME0505XC | 991 |
| NME0509XC | 3524 |
| NME0512XC | 5630 |
| NME0515XC | 7750 |
| NME0524XC | 19850 |
| NME1205XC | 682 |
| NME1209XC | 2102 |
| NME1212XC | 4030 |
| NME1215XC | 6193 |
| NME1515SC | 685 |
| NME2405XC | 135 |
| NME2409XC | 260 |
| NME2412XC | 430 |
| NME2415XC | 640 |
| NME0505XPC | 350 |

Typical Start-Up Wave Form



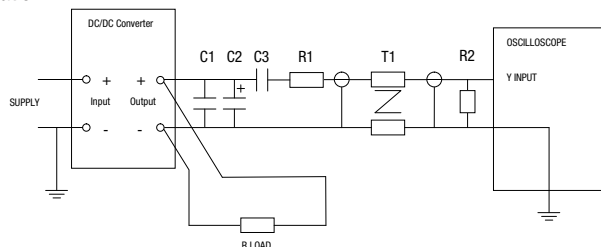
Ripple & Noise Characterisation Method

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 (continued)

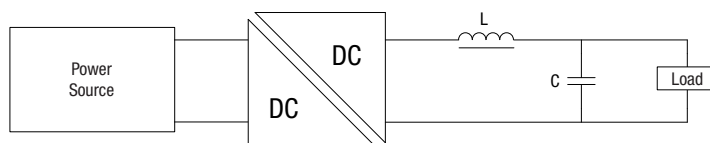
Output Ripple Reduction

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.

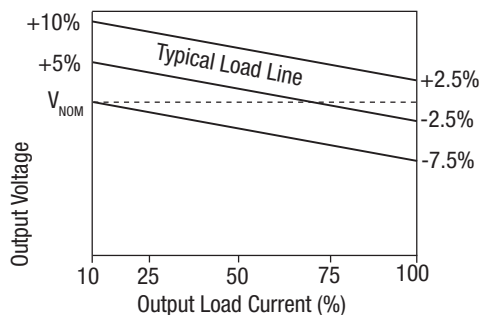


| | Inductor | | | Capacitor |
|------------|------------|--------|--------------|--------------|
| | L, μ H | SMD | Through Hole | C, μ F |
| NME0505XC | 47 | 82473C | 11R473C | 4.7 μ F |
| NME0509XC | 47 | 82473C | 11R473C | 1 μ F |
| NME0512XC | 68 | 82683C | 11R683C | 1 μ F |
| NME0515XC | 100 | 82104C | 11R104C | 0.47 μ F |
| NME0524XC | 100 | 82104C | 11R104C | 0.47 |
| NME1205XC | 100 | 82104C | 11R104C | 4.7 μ F |
| NME1209XC | 47 | 82473C | 11R473C | 1 μ F |
| NME1212XC | 68 | 82683C | 11R683C | 0.47 μ F |
| NME1215XC | 100 | 82104C | 11R104C | 0.47 μ F |
| NME1515SC | | | | |
| NME2405XC | | | | |
| NME2409XC | | | | |
| NME2412XC | | | | |
| NME2415XC | | | | |
| NME0505XPC | 22 | 82223C | 11R223C | 1 μ F |

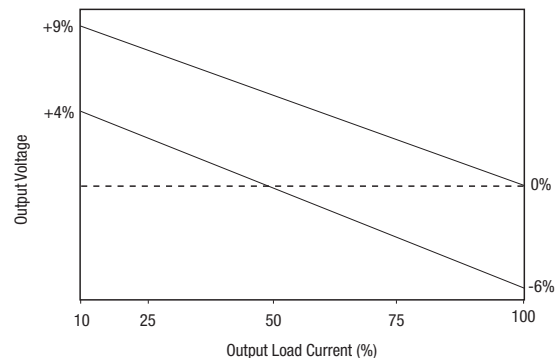
TOLERANCE ENVELOPES

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.

5V, 12V, 15V & 24V Input types

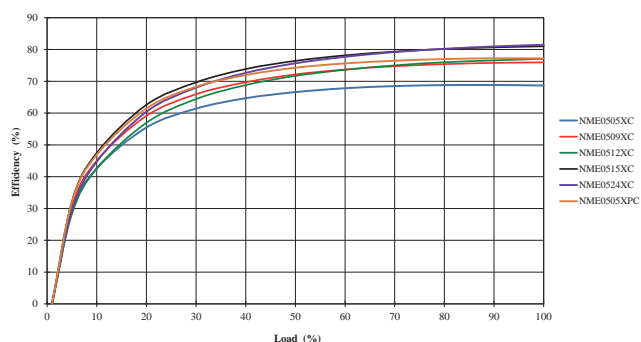


Short circuit

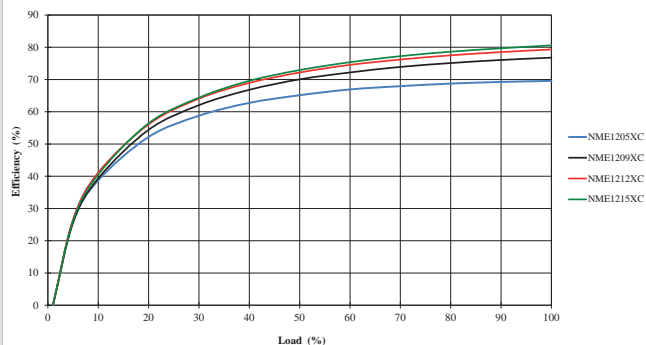


EFFICIENCY VS LOAD

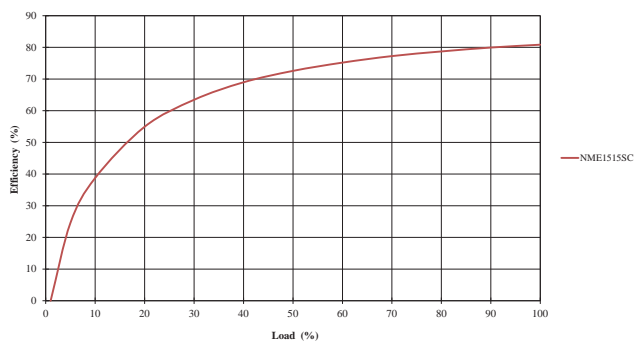
5V & Short circuit input variants



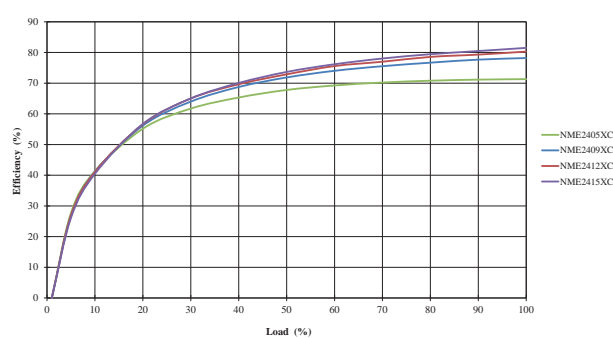
12V Inputs



15V Inputs



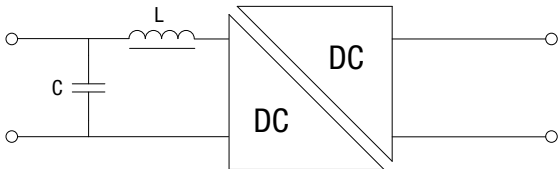
24V Inputs



EMC FILTERING AND SPECTRA

FILTERING

The following table shows the additional input capacitor and input inductor 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 |
| NME0505XC | 4.7 | | 13R472C | 4.7 |
| NME0509XC | | | | |
| NME0512XC | | | | |
| NME0515XC | 4.7 | | 13R472C | 4.7 |
| NME0524XC | | | | |
| NME1205XC | 10 | | 13R103C | 1 |
| NME1209XC | | | | |
| NME1212XC | 10 | | 13R103C | 1 |

| Part Number | Inductor | | | Capacitor |
|-------------|------------|--------|--------------|------------|
| | L, μ H | SMD | Through Hole | C, μ F |
| NME1215XC | | | | |
| NME1515SC | | | | |
| NME2405XC | 22 | | 13R223C | 10 |
| NME2409XC | | | | |
| NME2412XC | 22 | | 13R223C | 10 |
| NME2415XC | | | | |
| NME0505XPC | 10 | 82103C | 13R103C | 1 |

NME0505XC

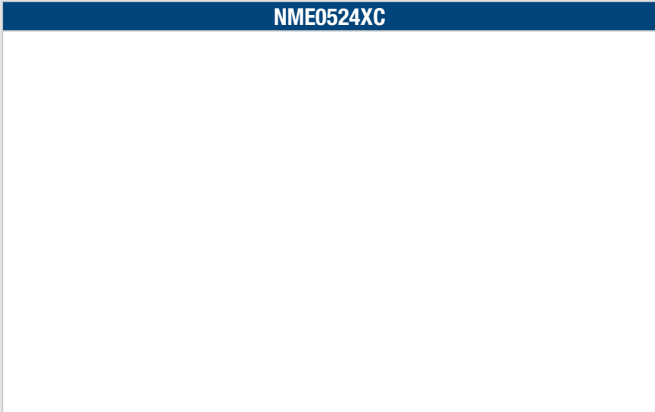
NME0509XC

NME0512XC

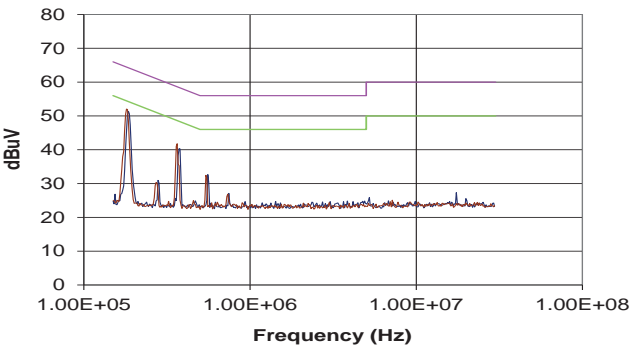
NME0515XC

EMC FILTERING AND SPECTRA

NME0524XC



NME0505XPC



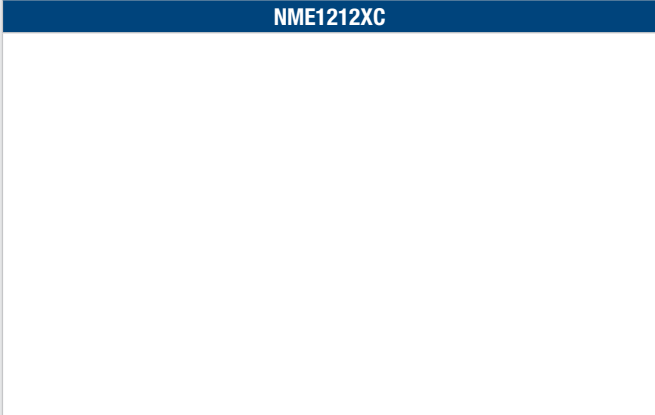
NME1205XC



NME1209XC



NME1212XC



NME1215XC

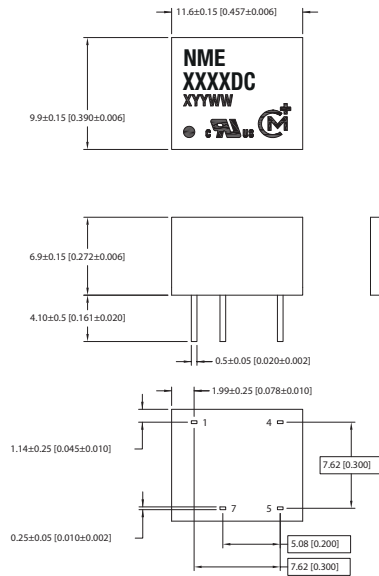


| EMC FILTERING AND SPECTRA | |
|---------------------------|----------------------|
| <div>NME1515SC</div> | <div>NME2405XC</div> |
| <div>NME2409XC</div> | <div>NME2412XC</div> |
| <div>NME2415XC</div> | |

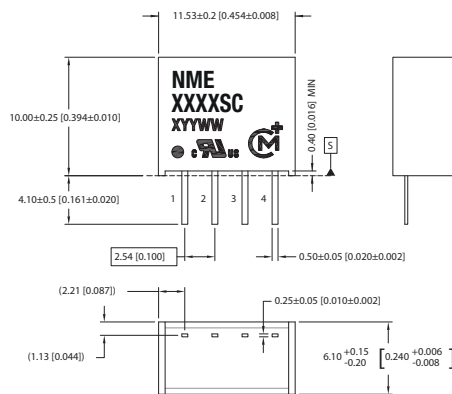
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

DIP Package



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'

Weight: 1.30g (SIP) 1.48g (DIP) 1.5g (SP DIP)

PIN CONNECTIONS - 8 PIN DIP

| Pin | Function |
|-----|-------------------|
| 1 | -V _{IN} |
| 4 | +V _{IN} |
| 5 | +V _{OUT} |
| 7 | -V _{OUT} |

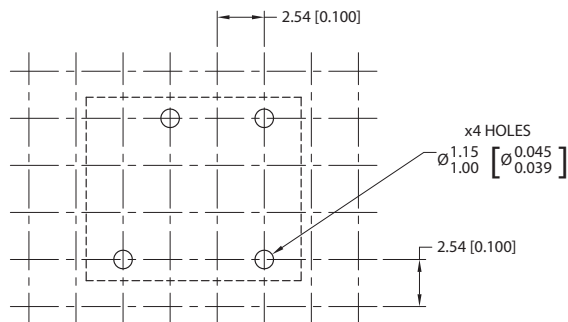
PIN CONNECTIONS - 4 PIN SIP

| Pin | Function |
|-----|-------------------|
| 1 | -V _{IN} |
| 2 | +V _{IN} |
| 3 | -V _{OUT} |
| 4 | +V _{OUT} |

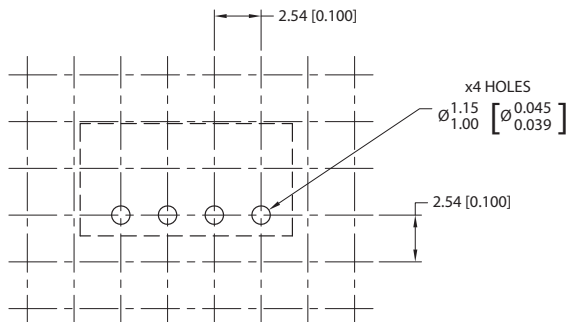
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

8 Pin DIP Package

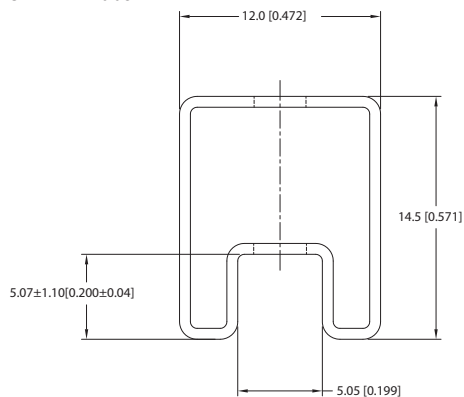


4 Pin SIP Package

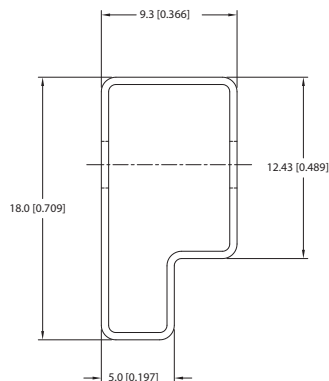


TUBE OUTLINE DIMENSIONS

8 Pin DIP Tube



4 Pin SIP Tube



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].
 Tube Length (8 Pin DIP) : 520mm [20.472] ±2.0 [0.079].
 Tube Length (4 Pin SIP) : 520mm [20.472] ±2.0 [0.079].

Tube Quantity : 35



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/>

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