



## FEATURES

- RoHS compliant
- Output regulation <1.5%
- Output programmable
- Power density 0.85W/cm<sup>3</sup>
- Single isolated output
- SIP & DIP package styles
- UL 94V-0 package material
- No heatsink required
- Footprint from 1.17cm<sup>2</sup>
- 1kVDC isolation
- 5V, 12V, 24V & 48V input
- 5V, 9V, 12V & 15V output
- SMD construction
- Fully encapsulated with toroidal magnetics
- No external components required
- MTTF up to 2.4 million hours
- PCB mounting

## DESCRIPTION

The NMF series of DC/DC converters is used where a tightly regulated supply is required. They are ideal for situations where the input voltage is not tightly controlled. The output trim pin makes the device particularly suitable for applications requiring a programmable output voltage. The 5V output version can be used to give a regulated output, adjustable between 1.2V and 5.0V with a single resistor. An option not to have this function is available, on SIP package type parts, prefix C with N. The single rail regulated output makes the ideal choice to power sensors, such as pressure transducers, hall effect sensors and mass airflow sensors.



# NMF Series

## Isolated 1W Regulated Single Output DC/DC Converters

### SELECTION GUIDE

| Order Code | Nominal Input Voltage | Output Voltage | Output Current | Power Out | Efficiency | Isolation Capacitance | MTTF <sup>1</sup> | Package Style |                         |
|------------|-----------------------|----------------|----------------|-----------|------------|-----------------------|-------------------|---------------|-------------------------|
|            | V                     | V              | mA             | mW        | %          | pF                    | kHrs              |               |                         |
| NMF0505DC  | 5                     | 5              | 100            | 500       | 50         | 37                    | 1307              | DIP           |                         |
| NMF0512DC  | 5                     | 12             | 83             | 1000      | 62         | 46                    | 512               | DIP           |                         |
| NMF0515DC  | 5                     | 15             | 67             | 1000      | 62         | 52                    | 316               | DIP           |                         |
| NMF0505SC  | 5                     | 5              | 100            | 500       | 50         | 37                    | 1307              | SIP           |                         |
| NMF0512SC  | 5                     | 12             | 83             | 1000      | 62         | 46                    | 512               | SIP           |                         |
| NMF0515SC  | 5                     | 15             | 67             | 1000      | 62         | 52                    | 316               | SIP           |                         |
| NMF1205DC  | 12                    | 5              | 100            | 500       | 50         | 62                    | 456               | DIP           |                         |
| NMF1212DC  | 12                    | 12             | 83             | 1000      | 62         | 98                    | 290               | DIP           |                         |
| NMF1215DC  | 12                    | 15             | 67             | 1000      | 62         | 108                   | 218               | DIP           |                         |
| NMF1205SC  | 12                    | 5              | 100            | 500       | 50         | 62                    | 456               | SIP           |                         |
| NMF1212SC  | 12                    | 12             | 83             | 1000      | 62         | 98                    | 290               | SIP           |                         |
| NMF1215SC  | 12                    | 15             | 67             | 1000      | 62         | 108                   | 218               | SIP           |                         |
| NMF2405DC  | 24                    | 5              | 100            | 500       | 50         | 69                    | 843               | DIP           |                         |
| NMF2409DC  | 24                    | 9              | 100            | 900       | 62         | 106                   | 613               | DIP           |                         |
| NMF2412DC  | 24                    | 12             | 83             | 1000      | 62         | 129                   | 422               | DIP           |                         |
| NMF2415DC  | 24                    | 15             | 67             | 1000      | 62         | 151                   | 279               | DIP           |                         |
| NMF2405SC  | 24                    | 5              | 100            | 500       | 50         | 69                    | 843               | SIP           |                         |
| NMF2409SC  | 24                    | 9              | 100            | 900       | 62         | 106                   | 613               | SIP           |                         |
| NMF2412SC  | 24                    | 12             | 83             | 1000      | 62         | 129                   | 422               | SIP           |                         |
| NMF2415SC  | 24                    | 15             | 67             | 1000      | 62         | 151                   | 279               | SIP           |                         |
| Obsolete   |                       |                |                |           |            |                       |                   |               | Recommended Alternative |
| NMF0509DC  | 5                     | 9              | 100            | 900       | 62         | 42                    | 825               | DIP           | Contact Murata          |
| NMF0509SC  | 5                     | 9              | 100            | 900       | 62         | 42                    | 825               | SIP           | Contact Murata          |
| NMF1209DC  | 12                    | 9              | 100            | 900       | 62         | 82                    | 379               | DIP           | Contact Murata          |
| NMF1209SC  | 12                    | 9              | 100            | 900       | 62         | 82                    | 379               | SIP           | Contact Murata          |
| NMF4805DC  | 48                    | 5              | 100            | 500       | 50         | 51                    | 200               | DIP           | Contact Murata          |
| NMF4809DC  | 48                    | 9              | 100            | 900       | 62         | 86                    | 283               | DIP           | Contact Murata          |
| NMF4812DC  | 48                    | 12             | 83             | 1000      | 62         | 108                   | 162               | DIP           | Contact Murata          |
| NMF4815DC  | 48                    | 15             | 67             | 1000      | 62         | 127                   | 135               | DIP           | Contact Murata          |
| NMF4805SC  | 48                    | 5              | 100            | 500       | 50         | 51                    | 200               | SIP           | Contact Murata          |
| NMF4809SC  | 48                    | 9              | 100            | 900       | 62         | 86                    | 283               | SIP           | Contact Murata          |
| NMF4812SC  | 48                    | 12             | 83             | 1000      | 62         | 108                   | 162               | SIP           | Contact Murata          |
| NMF4815SC  | 48                    | 15             | 67             | 1000      | 62         | 127                   | 135               | SIP           | Contact Murata          |

When operated with additional external load capacitance the rise time of the input voltage will determine the maximum external capacitance value for guaranteed start up. The slower the rise time of the input voltage the greater the maximum value of the additional external capacitance for reliable start up.

### ABSOLUTE MAXIMUM RATINGS

|                                                 |          |
|-------------------------------------------------|----------|
| Short-circuit protection <sup>2</sup>           | 1 second |
| Lead temperature 1.5mm from case for 10 seconds | 300°C    |
| Internal power dissipation                      | 450mW    |
| Input voltage V <sub>IN</sub> , NMF05 types     | 7V       |
| Input voltage V <sub>IN</sub> , NMF12 types     | 15V      |
| Input voltage V <sub>IN</sub> , NMF24 types     | 28V      |
| Input voltage V <sub>IN</sub> , NMF48 types     | 54V      |

1. Calculated using MIL-HDBK-217F with nominal input voltage at full load.

2. Supply voltage must be discontinued at the end of the short circuit duration.

All specifications typical at T<sub>A</sub>=25°C, nominal input voltage and rated output current unless otherwise specified.

#### INPUT CHARACTERISTICS

| Parameter     | Conditions                            | Min. | Typ. | Max. | Units |
|---------------|---------------------------------------|------|------|------|-------|
| Voltage range | Continuous operation, 5V input types  | 4.75 | 5    | 5.25 | V     |
|               | Continuous operation, 12V input types | 11.4 | 12   | 12.6 |       |
|               | Continuous operation, 24V input types | 22.8 | 24   | 25.2 |       |
|               | Continuous operation, 48V input types | 45.6 | 48   | 50.4 |       |

#### OUTPUT CHARACTERISTICS

| Parameter                  | Conditions                                  | Min. | Typ. | Max. | Units  |
|----------------------------|---------------------------------------------|------|------|------|--------|
| Voltage set point accuracy | 100% load                                   |      |      | 5    | %      |
| Rated power <sup>1</sup>   | T <sub>A</sub> = 0°C to 70°C                |      |      | 1    | W      |
| Line regulation            | High V <sub>IN</sub> to low V <sub>IN</sub> |      |      | 0.25 | %/%    |
| Load regulation            | 10% load to rated load                      |      | 0.9  | 1.5  | %      |
| Ripple & noise             | BW=DC to 20MHz, all output types            |      |      | 60   | mV p-p |

#### ISOLATION CHARACTERISTICS

| Parameter              | Conditions                | Min. | Typ. | Max. | Units |
|------------------------|---------------------------|------|------|------|-------|
| Isolation test voltage | Flash tested for 1 second | 1000 |      |      | VDC   |
| Resistance             | Viso= 500VDC              | 0.1  |      |      | GΩ    |

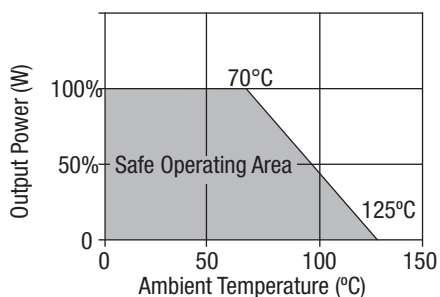
#### GENERAL CHARACTERISTICS

| Parameter           | Conditions      | Min. | Typ. | Max. | Units |
|---------------------|-----------------|------|------|------|-------|
| Switching frequency | All input types |      | 90   |      | kHz   |

#### TEMPERATURE CHARACTERISTICS

| Parameter                      | Conditions          | Min. | Typ. | Max. | Units |
|--------------------------------|---------------------|------|------|------|-------|
| Specification                  | All output types    | 0    |      | 70   | °C    |
| Case temperature above ambient |                     |      | 38   |      |       |
| Storage                        |                     | -55  |      | 150  |       |
| Cooling                        | Free air convection |      |      |      |       |

#### TEMPERATURE DERATING GRAPH



#### RoHS COMPLIANCE INFORMATION

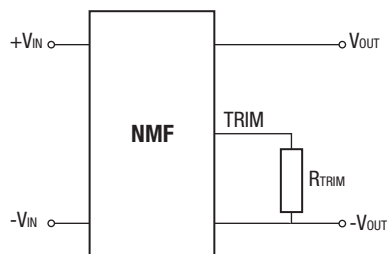


This series is compatible with RoHS soldering systems with a peak wave solder temperature of 300°C for 10 seconds. The pin termination finish on the SIP package type is Tin Plate, Hot Dipped over Matte Tin over Nickel Preplate. The DIP types are Matte Tin over Nickel Preplate. Both types in this series are backward compatible with Sn/Pb soldering systems.

For further information, please visit [www.murata-ps.com/rohs](http://www.murata-ps.com/rohs)

#### OUTPUT VOLTAGE ADJUSTMENT (for 5V output variants)

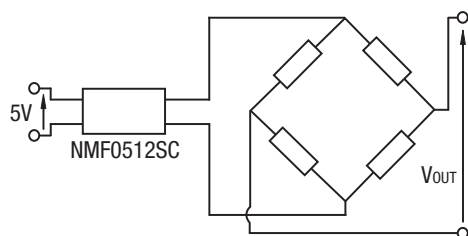
The trimming (adjust) input on the device allows output voltage adjustment from 1.2V to 3.3VDC by using a resistor as shown here. The table below provides R<sub>TRIM</sub> values for the most commonly required output voltages. For applications not requiring the TRIM function, this pin must be left unconnected for normal regulated output.



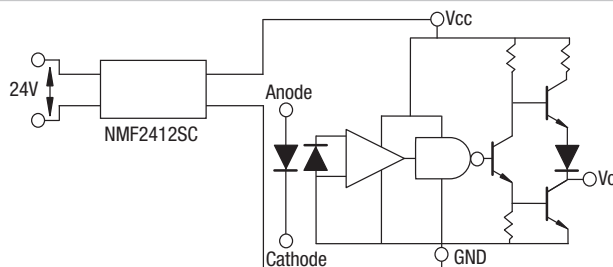
| V <sub>OUT SET</sub> (V) | R <sub>TRIM</sub> (Ω) |
|--------------------------|-----------------------|
| 1.2                      | 0                     |
| 1.5                      | 64                    |
| 2.0                      | 224                   |
| 2.1                      | 263                   |
| 2.2                      | 304                   |
| 2.5                      | 448                   |
| 3.3                      | 1071                  |

### TYPICAL APPLICATIONS

Pressure sensor, or strain gauge equivalent circuit



Scmitt Trigger



### 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 NMF 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 NMF 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

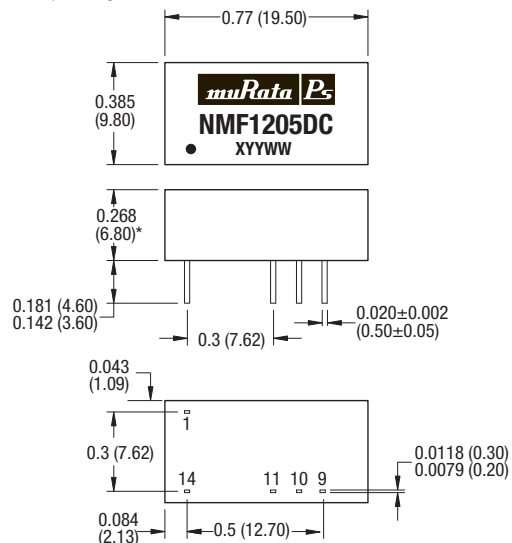
It is well known that repeated high-voltage isolation testing of a barrier component can actually degrade isolation capability, to a lesser or greater degree depending on materials, construction and environment. The NMF series has toroidal isolation transformers, with no additional insulation between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

### PACKAGE SPECIFICATIONS

#### MECHANICAL DIMENSIONS

##### DIP package



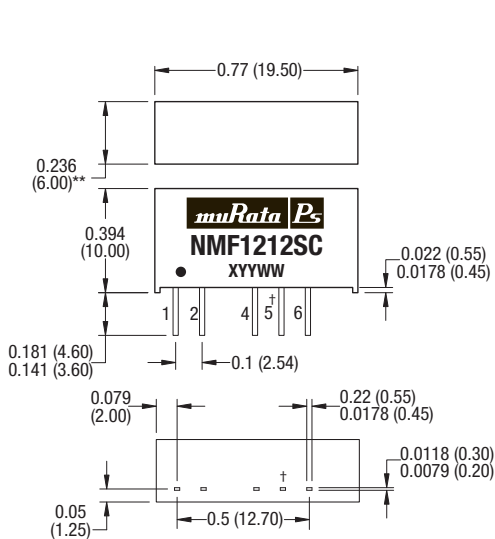
† Trim pin not fitted on suffix SNC parts.

\* 0.303 (7.70) for 24V & 48V variants

\*\* 0.295 (7.50) for 24V & 48V variants

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.

##### SIP package



Weight: 2.4g (DIP) 2.1g (SIP) except for NMF24XX and NMF48XX DIP & SIP : 2.9g

#### PIN CONNECTIONS - 14 PIN DIP

| Pin | Function          |
|-----|-------------------|
| 1   | -V <sub>IN</sub>  |
| 9   | +V <sub>OUT</sub> |
| 10  | TRIM              |
| 11  | -V <sub>OUT</sub> |
| 14  | +V <sub>IN</sub>  |

#### PIN CONNECTIONS - 7 PIN SIP

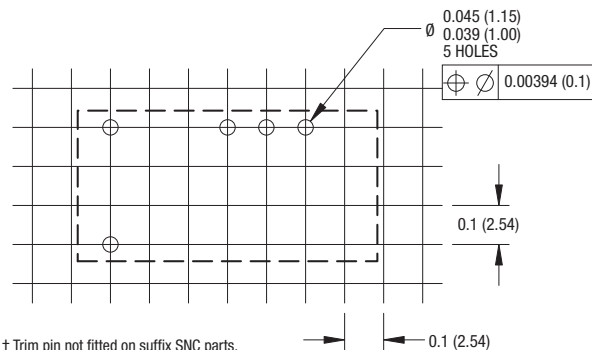
| Pin | Function          |
|-----|-------------------|
| 1   | +V <sub>IN</sub>  |
| 2   | -V <sub>IN</sub>  |
| 4   | -V <sub>OUT</sub> |
| 5   | TRIM†             |
| 6   | +V <sub>OUT</sub> |

1. See derating graph.

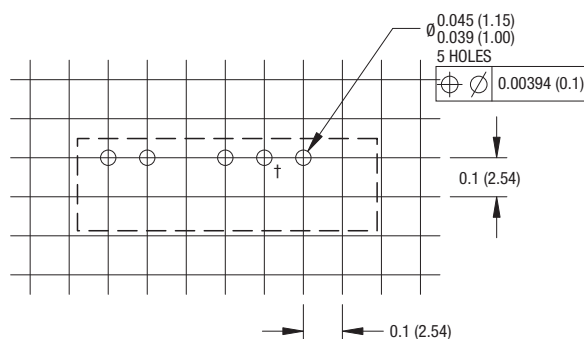
**PACKAGE SPECIFICATIONS (continued)**

**RECOMMENDED FOOTPRINT DETAILS**

**14 Pin DIP Package**

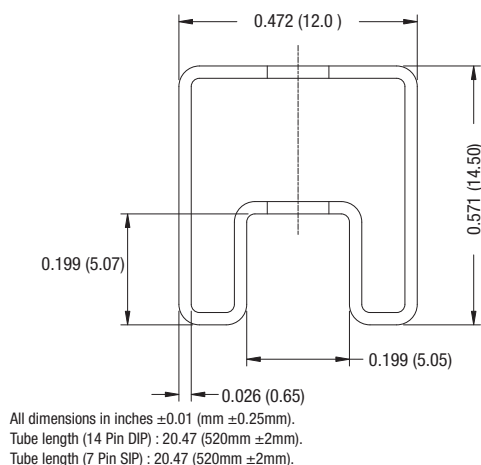


**7 Pin SIP Package**

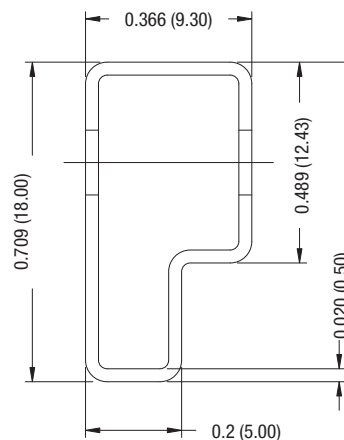


**TUBE OUTLINE DIMENSIONS**

**14 Pin DIP Tube**



**7 Pin SIP Tube**



Tube Quantity : 25

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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/>

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