



### FEATURES

- RoHS compliant
- 1kVDC isolation
- Efficiency up to 80%
- Wide temperature performance at full 1 watt load, -40°C to 85°C
- Power density up to 0.90W/cm<sup>3</sup>
- UL 94V-0 package material
- Footprint from 1.17cm<sup>2</sup>
- Industry standard pinout
- 5V, 12V, 15V & 24V input
- 5V, 12V & 15V output
- No heatsink required
- Internal SMD construction
- 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.

### SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Load Regulation		Ripple & Noise <sup>3</sup>		Efficiency	Isolation Capacitance	MTTF <sup>1</sup>
	V	V	mA	mA	Typ.	Max.	Typ.	Max.	%	pF	kHrs
NMR100C	5	5	200	290	12.5	13.4	6	10	69	28	1847
NMR101C	5	12	83	260	6.90	7.70	4.6	10	77	33	981
NMR102C	5	15	67	253	6.50	7.50	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	6.90	7.70	5	10	76	58	869
NMR108C	12	15	67	110	6.50	7.50	4	10	76	56	613
NMR112C	15	5	200	93	8.1	10	14	20	69	27	2110
NMR113C	15	12	83	85	3.3	4	12	15	77	58	1790
NMR114C	15	15	67	84	2.8	3.5	14	20	78	67	1560
NMR118C	24	5	200	60	6.80	10	8	15	70	61	1253
NMR119C	24	12	83	53	2.80	4.0	7	15	78	98	784
NMR120C	24	15	67	52	2.50	3.50	8	15	80	122	566

### 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	
Reflected ripple current	5V & 12V input types		1.6	2	mA p-p
	15V & 24V input types		5	10	

### OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power <sup>2</sup>	T <sub>A</sub> = -40°C to 85°C			1.0	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V <sub>IN</sub> to low V <sub>IN</sub>		1.0	1.2	%/%

### ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage	Flash tested for 1 second	1000			VDC
Resistance	V <sub>iso</sub> = 1000VDC	10			GΩ

### ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	300°C
Internal power dissipation	550mW
Input voltage V <sub>IN</sub> , NMR100C, NMR101C, NMR102C	7V
Input voltage V <sub>IN</sub> , NMR106C, NMR107C, NMR108C	15V
Input voltage V <sub>IN</sub> , NMR112C, NMR113C, NMR114C	18V
Input voltage V <sub>IN</sub> , NMR118C, NMR119C, NMR120C	28V

1. Calculated using MIL-HDBK-217FN2 with nominal input voltage at full load.

2. See derating graph.

3. See ripple & noise characterisation method.

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



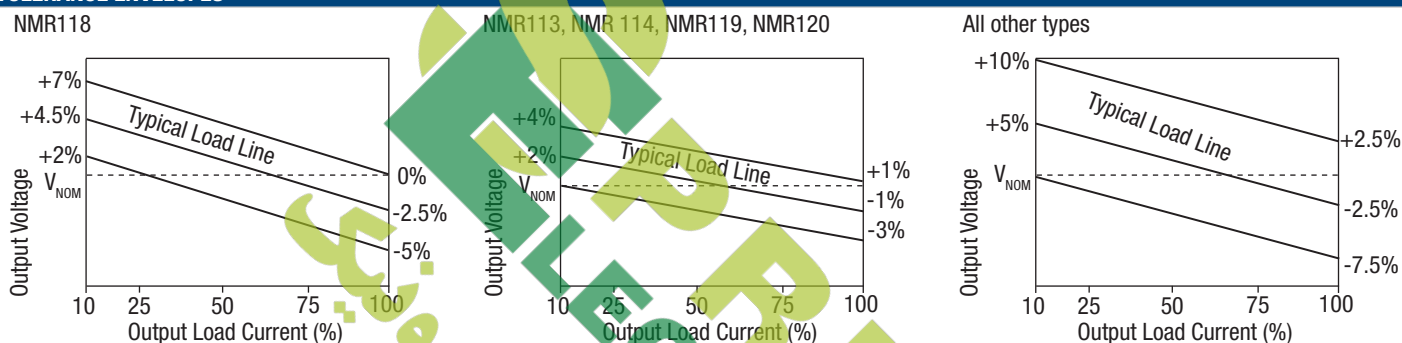
### GENERAL CHARACTERISTICS

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		

### 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		
Cooling	Free air convection				

### 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.

### 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?"

For a part holding no specific agency approvals, such as the NMR 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 NMR 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.

**APPLICATION NOTES**

**Minimum load**

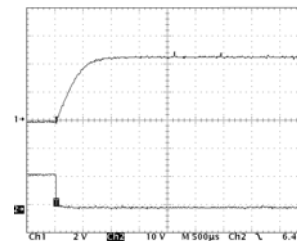
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

**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

Typical Start-Up Wave Form



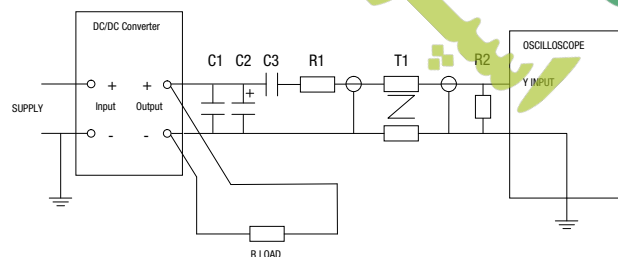
**Ripple & Noise Characterisation Method**

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 (continued)**

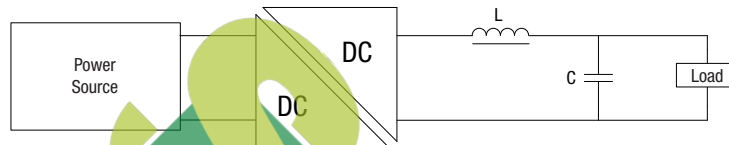
**Output Ripple Reduction**

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.

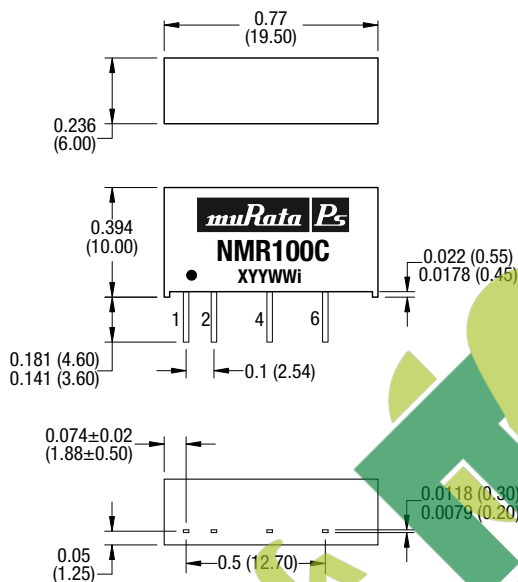


	L, $\mu$ H	Inductor		Capacitor
		SMD	Through Hole	C, $\mu$ F
NMR100C	10	82103C	11R103C	4.7
NMR101C	47	82473C	11R473C	1
NMR102C	47	82473C	11R473C	1
NMR106C	10	82103C	11R103C	4.7
NMR107C	47	82473C	11R473C	1
NMR108C	47	82473C	11R473C	1
NMR112C	10	82103C	11R103C	4.7
NMR113C	47	82473C	11R473C	1
NMR114C	47	82473C	11R473C	1
NMR118C	10	82103C	11R103C	4.7
NMR119C	47	82473C	11R473C	1
NMR120C	47	82473C	11R473C	1

**PACKAGE SPECIFICATIONS**

**MECHANICAL DIMENSIONS**

7 Pin SIP Package

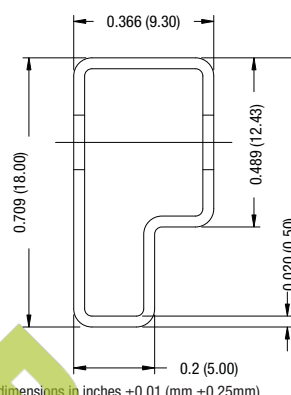


All dimensions in inches  $\pm 0.01$  (mm  $\pm 0.25$ mm). All pins on a 0.1 (2.54) pitch and within  $\pm 0.01$  (0.25) of true position. Weight: 2.1g

**PIN CONNECTIONS - 7 PIN SIP**

Pin	Function
1	+VIN
2	-VIN
4	-Vout
6	+Vout

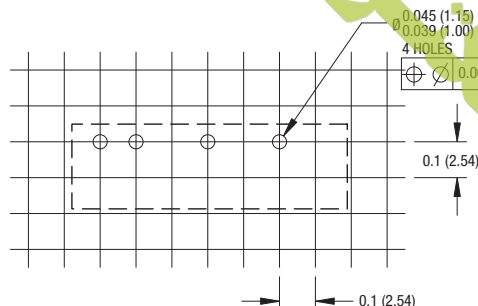
**TUBE OUTLINE DIMENSIONS**



All dimensions in inches  $\pm 0.01$  (mm  $\pm 0.25$ mm)

Tube quantity: 25

**RECOMMENDED FOOTPRINT DETAILS**



All dimensions in inches  $\pm 0.01$  (mm  $\pm 0.25$ mm)

**TEMPERATURE DERATING GRAPH**

