## ISOLATION CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Isolation test voltage | Flash tested for 1 seconds | 1500 | | | VDC |
| Resistance | Viso = 1kVDC | 1 | | | GΩ |
| Capacitance | | | 225 | | pF |

## GENERAL CHARACTERISTICS[1]

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Switching frequency | | | 180 | | kHz |

## TEMPERATURE CHARACTERISTICS

| Parameter | Conditions | | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Operation | All output types (see derating graphs) | | | -40 | | 85 | °C |
| Storage | | | | -50 | | 125 | |
| Case temperature rise above ambient | 100% Load, Nom $V_{IN}$, Still Air | 48$V_{IN}$ Dual outputs | 5V | | 36 | | |
| | | | 12V | | 32 | | |
| | | | 15V | | 31 | | |
| | | All other output types | 3.3V | | 32 | | |
| | | | 5V | | 32 | | |
| | | | 12V | | 28 | | |
| | | | 15V | | 26 | | |
| Thermal shutdown | Case Temperature | | | | 105 | | |

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Short-circuit protection (for SELV input voltages) | Continuous |
| Internal power dissipation | 2.1W |
| Lead temperature 1.0mm from case for 10 seconds (to JEDEC JESD22-B106 ISS C) | 260°C |
| Minimum output load for specification (see application notes) | 10% of rated load |
| 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, NCS6 12V input types | 40V |
| Input voltage, NCS6 48V input types | 80V |

## 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 NCS6 series of DC-DC converters are all 100% production tested at their stated isolation voltage. This is 1.5kVDC for 1 second.

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

The NCS6 has been recognised by Underwriters Laboratory for functional isolation. 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 NCS6 series has an ER ferrite core, 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 NCS6 series has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum ambient temperature of 85ºC and/or case temperature limit of 120ºC (case temperature measured on the face opposite the pins). File number E151252 applies.

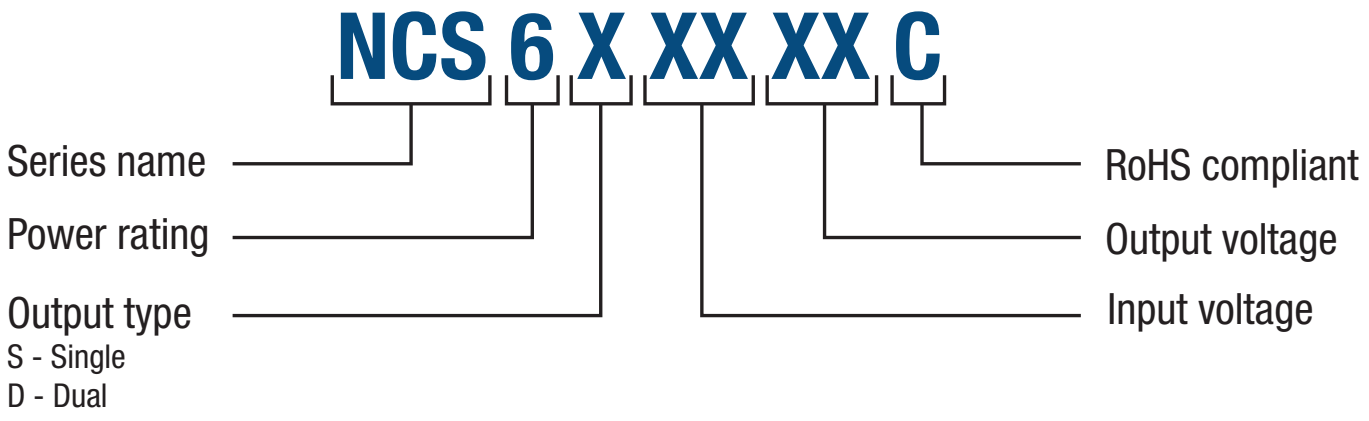
Note: This series gained UL 60950 recognition for products manufactured on or after datecode G1114, any NCS6 parts manufactured before this date code should not be considered UL 60950 recognised. Any NCS6 that is UL recognised will be printed with the UL logo.

## RoHS COMPLIANCE INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260ºC for 10 seconds. Please refer to application notes for further information. The pin termination finish on this product series is a Gold flash (0.05-0.10 micron) over Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems. For further information, please visit www.murata-ps.com/rohs

## PART NUMBER STRUCTURE



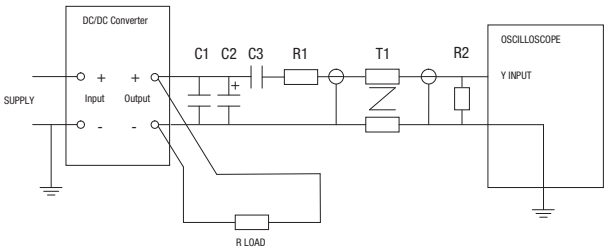
## CHARACTERISATION TEST METHODS

### 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

### Output Capacitors

The NCS6 series does not require output capacitors to meet datasheet specification. To meet datasheet specification, total output capacitance should not exceed:

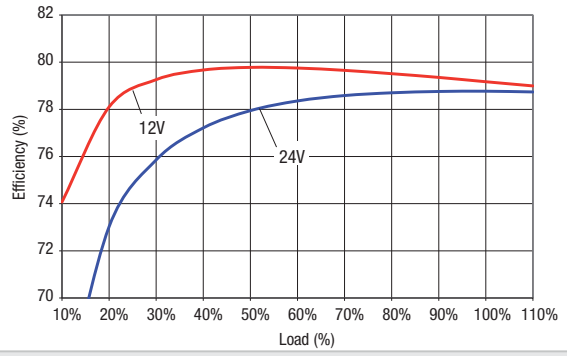
| Output Voltage (V) | Output Capacitance (µF) |
|---|---|
| 3.3 | 470 |
| 5 | 470 |
| 12 | 220 |
| 15 | 220 |

### Minimum Load

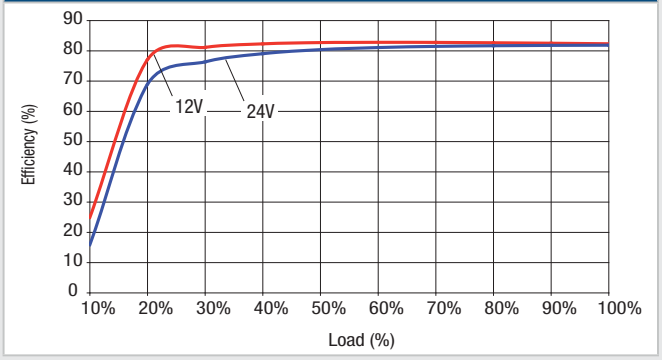
The minimum load to meet full datasheet specification is 10% of the full rated load across the specified input voltage range.
Between 0% and 10% output loading, the positive output voltage will remain within data sheet specification however, output ripple and noise will increase as well as a decrease in accuracy on negative outputs.

## EFFICIENCY VS LOAD

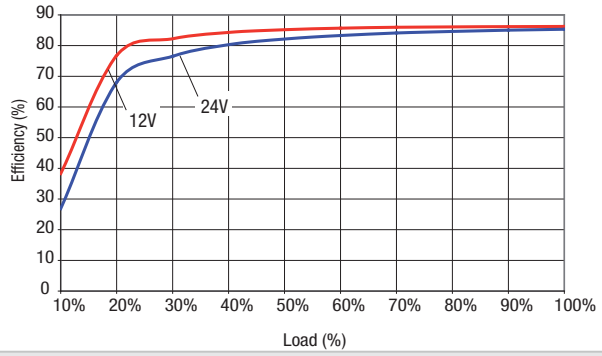
### NCS6S1203C



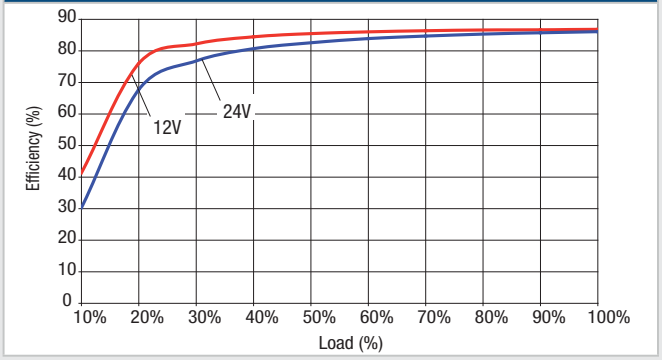

### NCS6S1205C



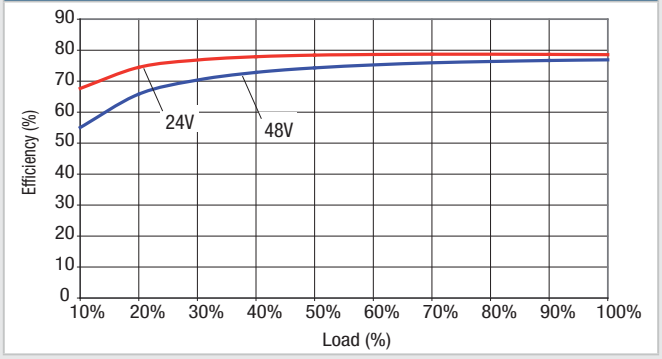

### NCS6S1212C



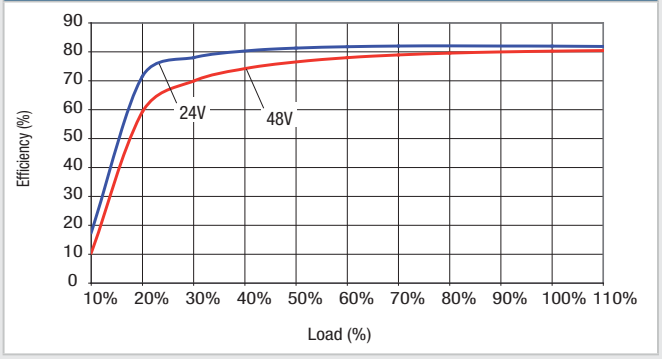

### NCS6S1215C



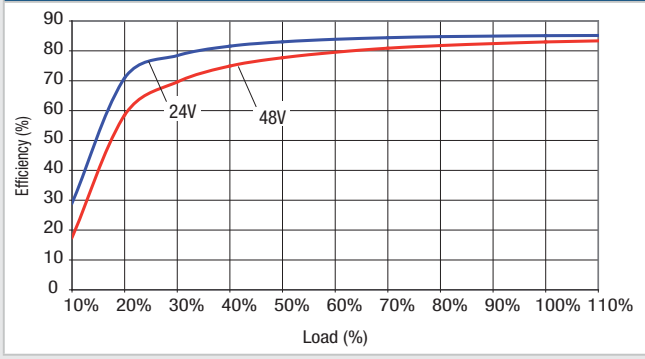

### NCS6S4803C



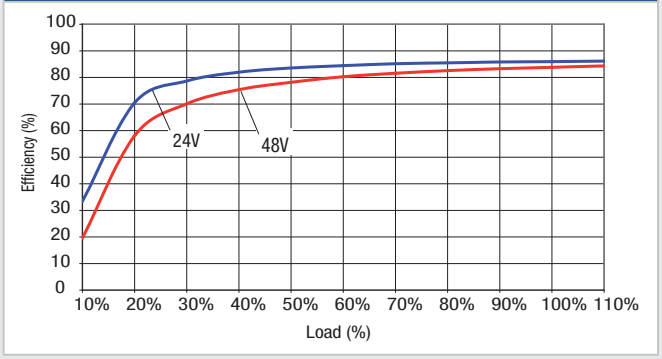

### NCS6S4805C




### NCS6S4812C

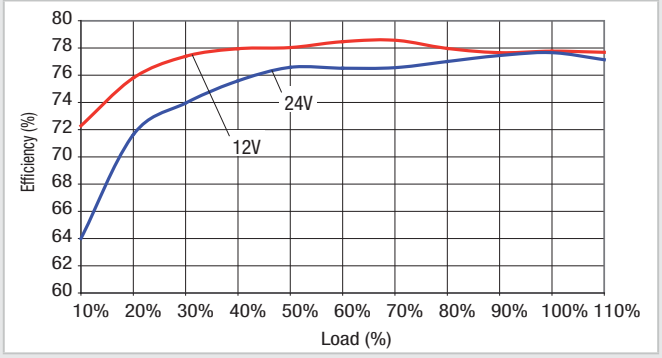



### NCS6S4815C

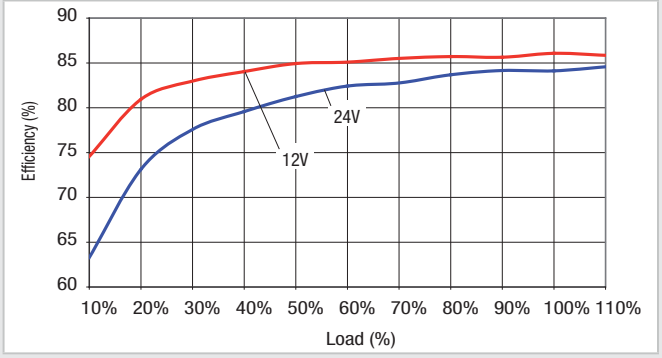


## EFFICIENCY VS LOAD (Continued)

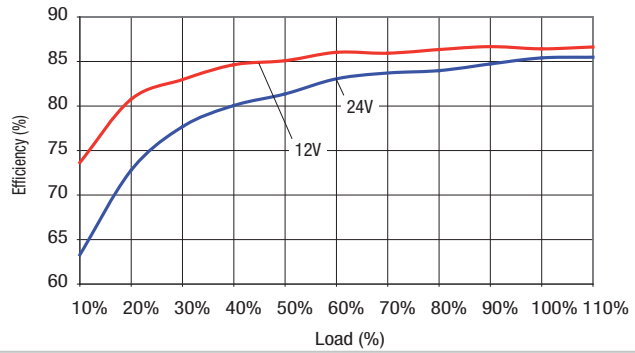
### NCS6D1205C



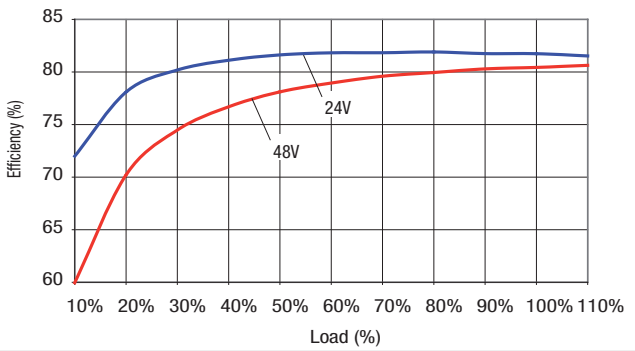

### NCS6D1212C



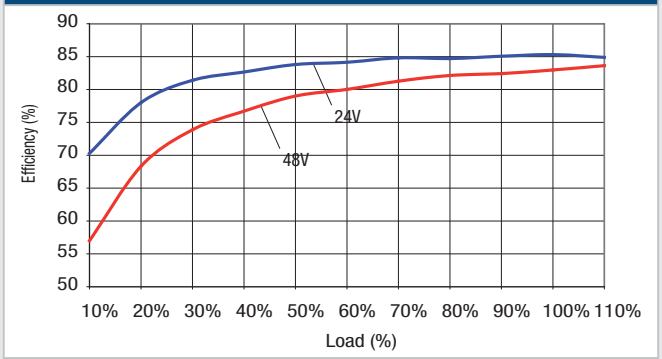

### NCS6D1215C



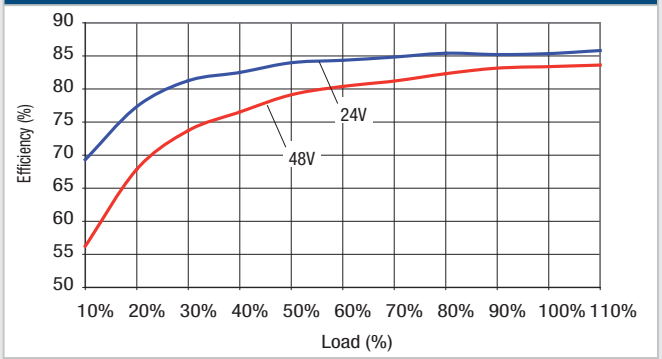

### NCS6D4805C




### NCS6D4812C

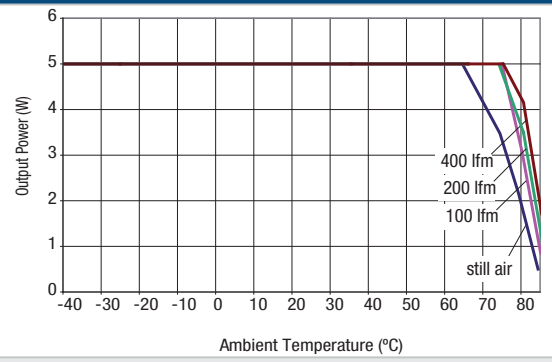



### NCS6D4815C

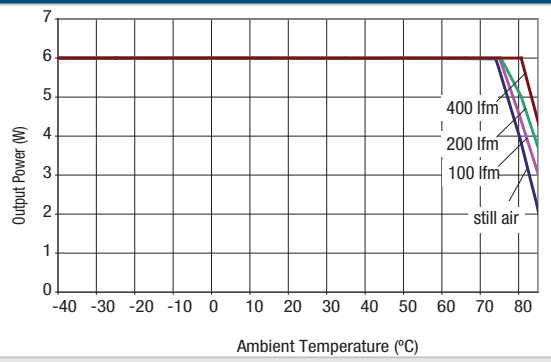


## TEMPERATURE DERATING

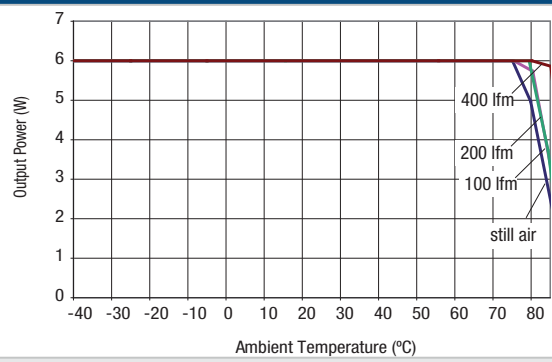
### NCS6S1203C



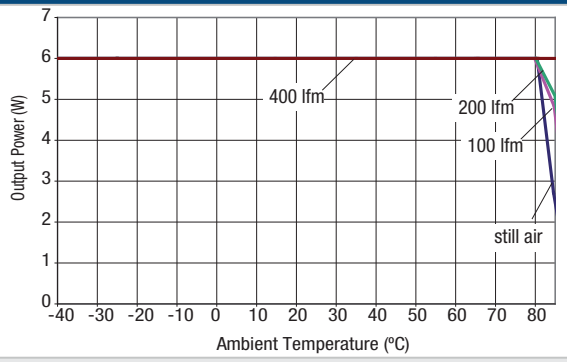

### NCS6S1205C



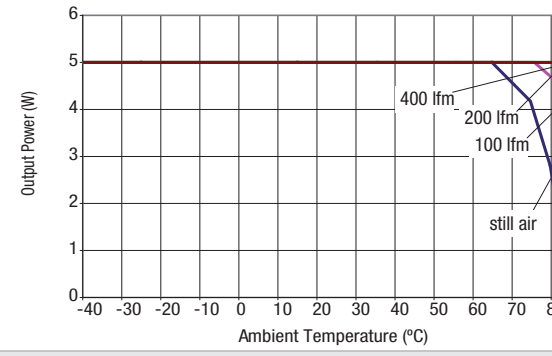

### NCS6S1212C



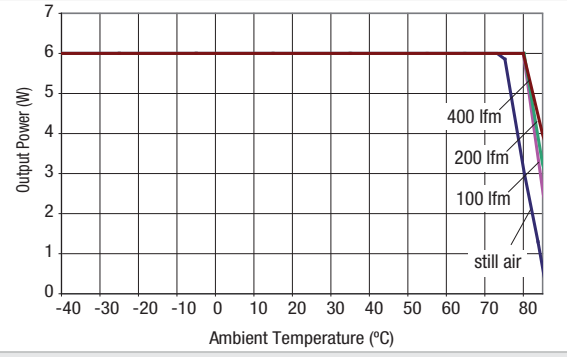

### NCS6S1215C



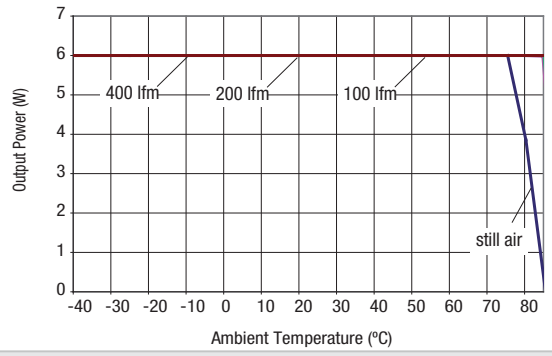

### NCS6S4803C



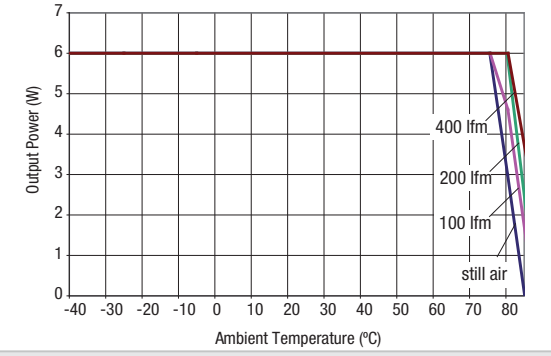

### NCS6S4805C




### NCS6S4812C

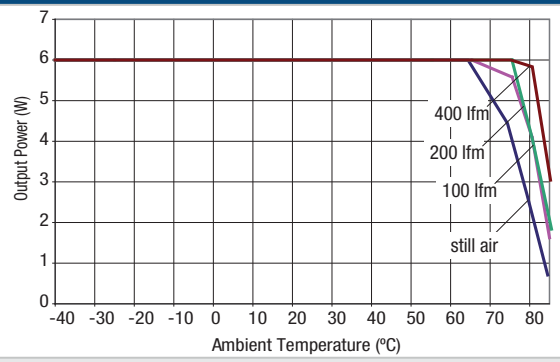



### NCS6S4815C

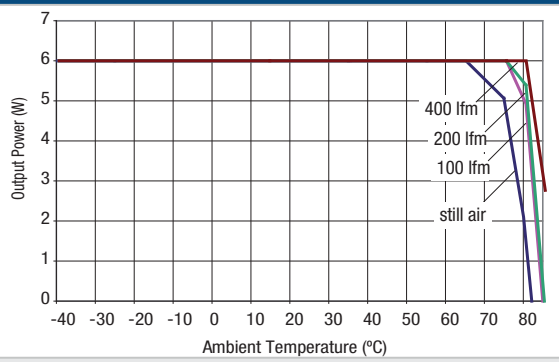


## TEMPERATURE DERATING (Continued)

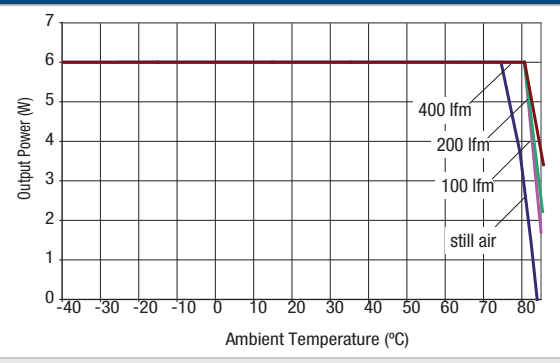
### NCS6D1205C



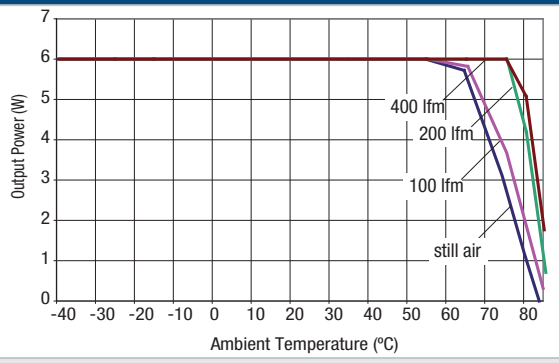

### NCS6D1212C



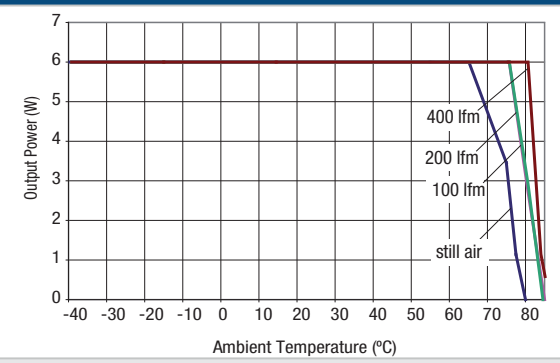

### NCS6D1215C



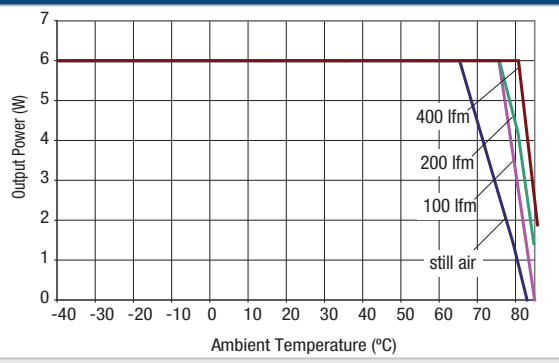

### NCS6D4805C




### NCS6D4812C




### NCS6D4815C



## EMC FILTERING AND SPECTRA

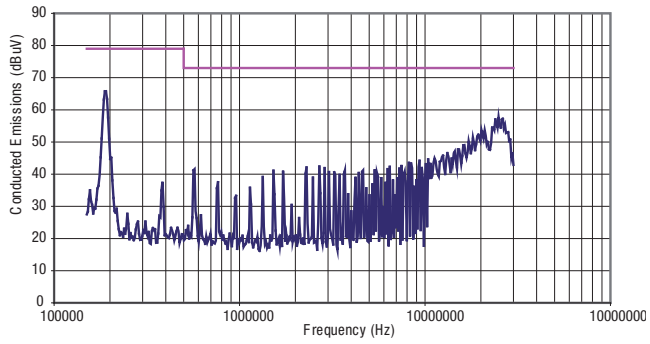
### FILTERING

The module includes a basic level of filtering, the following table shows the additional input capacitor typically required to meet EN 55022 Curve A Quasi-Peak EMC limit, as shown in the below plots.

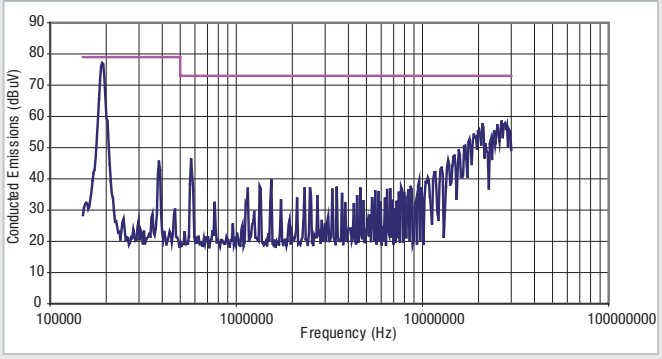
| | |
|---|---|
| NCS6D1205C | 2.2µF |
| NCS6D1212C | none |
| NCS6D1215C | none |
| NCS6D4805C | 10µF |
| NCS6D4812C | 10µF |
| NCS6D4815C | 10µF |

| | |
|---|---|
| NCS6S1203C | 4.7µF |
| NCS6S1205C | 4.7µF |
| NCS6S1212C | 10µF |
| NCS6S1215C | 10µF |
| NCS6S4803C | 4.7µF |
| NCS6S4805C | 10µF |
| NCS6S4812C | 10µF |
| NCS6S4815C | 10µF |

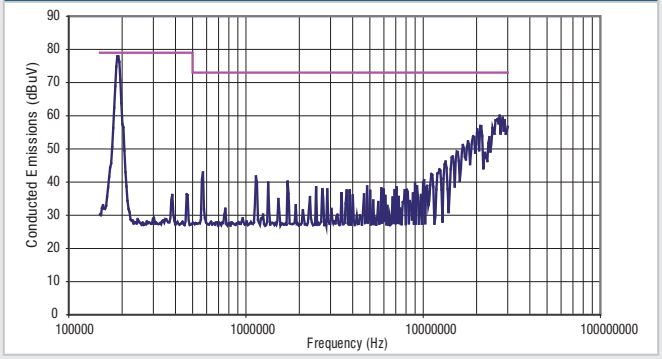
**NCS6D1205C**



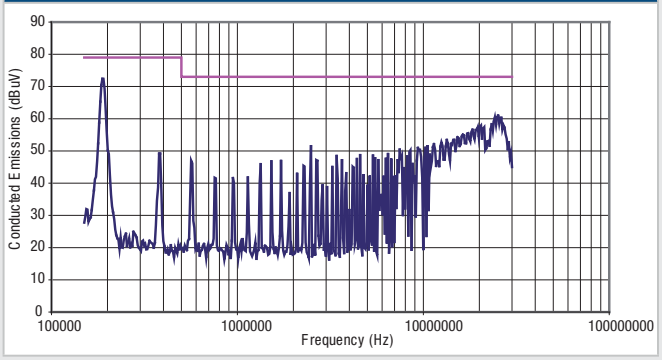

**NCS6D1212C**



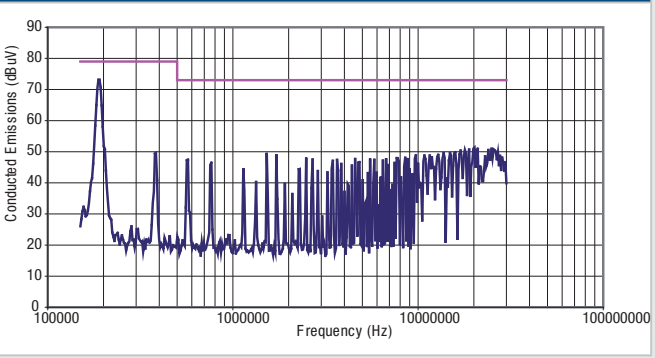

**NCS6D1215C**



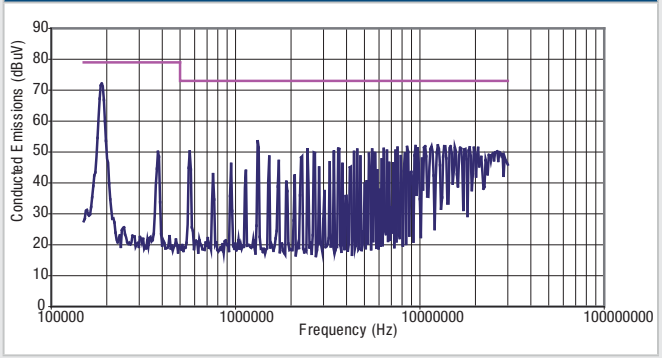

**NCS6D4805C**




**NCS6D4812C**

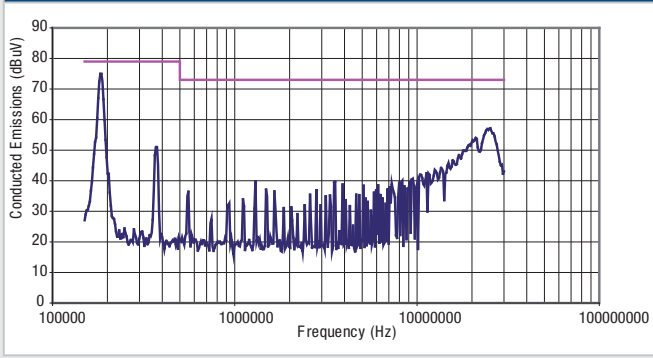



**NCS6D4815C**

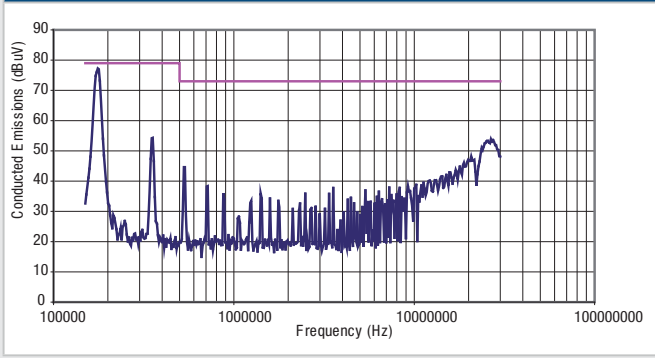


## EMC FILTERING AND SPECTRA (Continued)

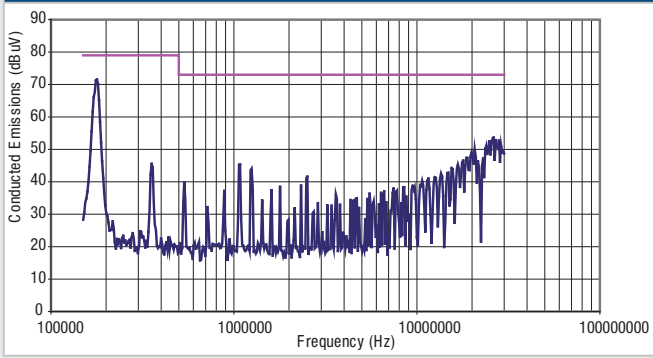
### NCS6S1203C



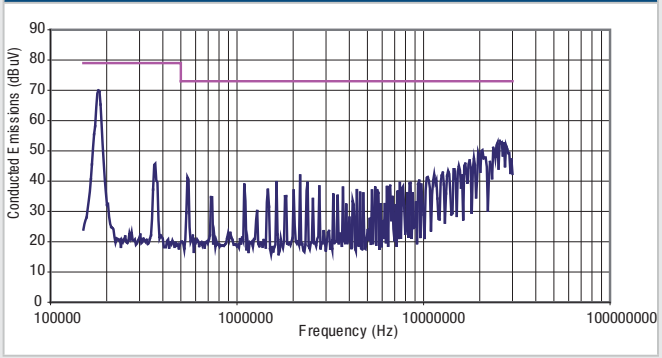

### NCS6S1205C



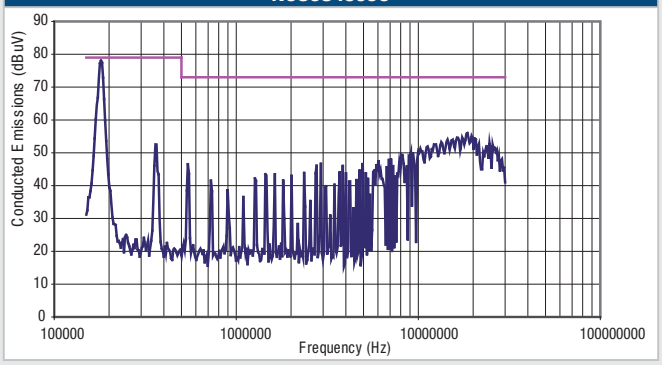

### NCS6S1212C



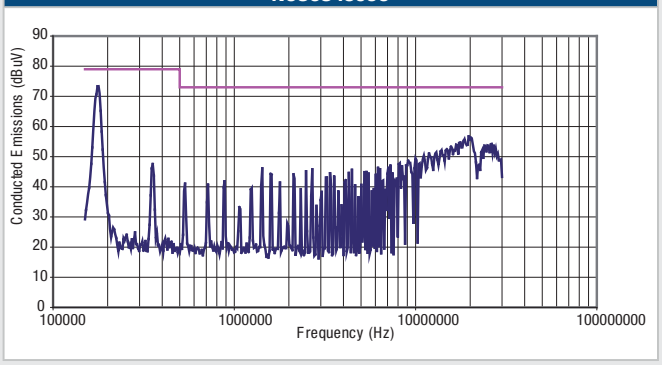

### NCS6S1215C



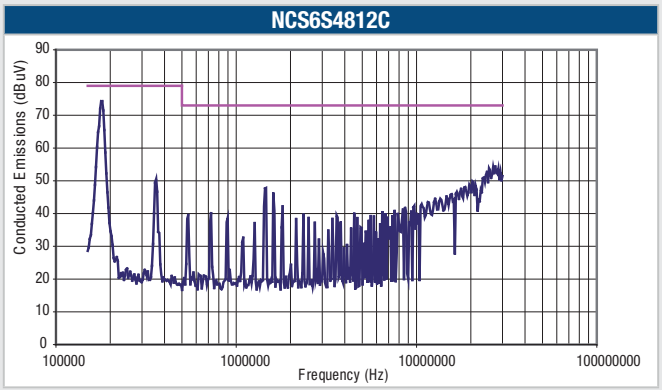

### NCS6S4803C



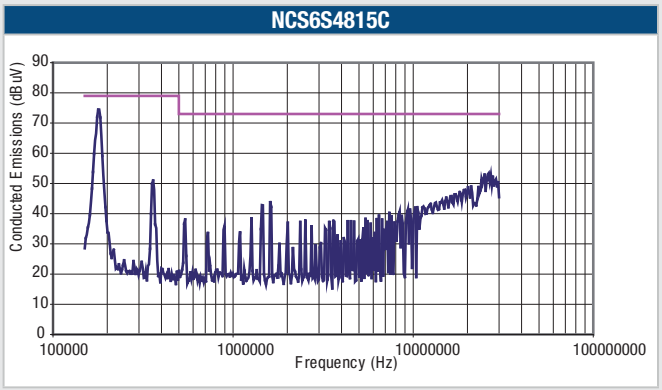

### NCS6S4805C




### NCS6S4812C

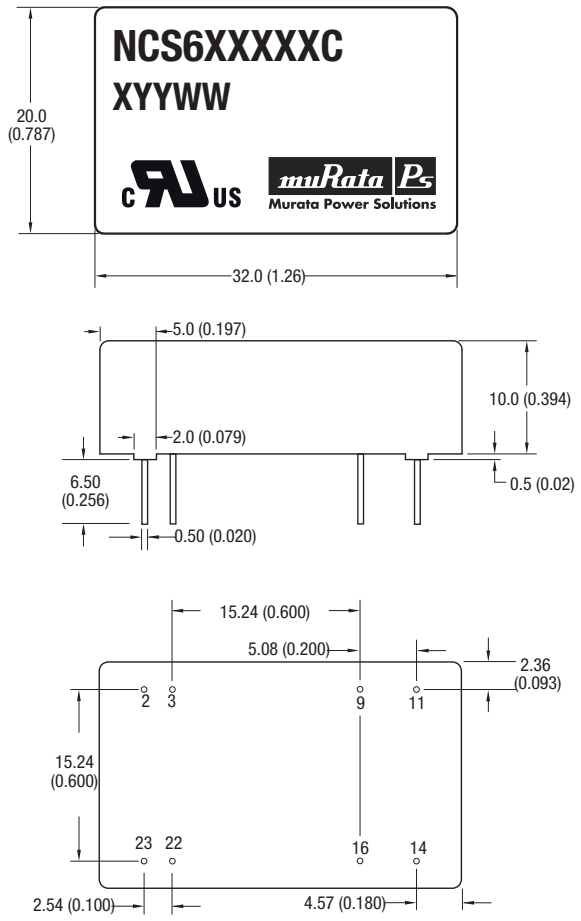



### NCS6S4815C



## PACKAGE SPECIFICATIONS

### MECHANICAL DIMENSIONS




All dimensions in mm (inches) ± 0.5 (0.020) except pin to pin tolerance ±0.25 (0.010).
All pins on a 2.54 (0.100) pitch and within 0.25 (0.010) of true position.

Weight: 17g

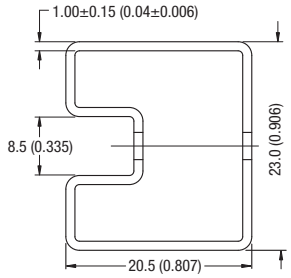
The copper case is connected to pin 16. Care is needed in the design of this circuit board on which the converter is mounted.
Top side tracks must not contact the edge of the case on the underside of the unit.

Please note that from 2010 onwards, you may receive either a blue or a black case.

### PIN CONNECTIONS

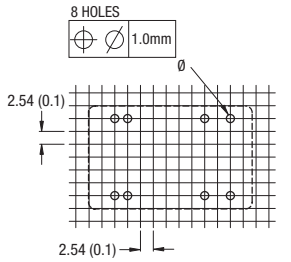
| Pin | Function | |
|---|---|---|
| | Single | Dual |
| 2 | -$V_{IN}$ | -$V_{IN}$ |
| 3 | -$V_{IN}$ | -$V_{IN}$ |
| 9 | No pin | 0V |
| 11 | N/C | -$V_{OUT}$ |
| 14 | +$V_{OUT}$ | +$V_{OUT}$ |
| 16 | -$V_{OUT}$ | 0V |
| 22 | +$V_{IN}$ | +$V_{IN}$ |
| 23 | +$V_{IN}$ | +$V_{IN}$ |

### TUBE OUTLINE DIMENSIONS




Tube length 520 (20.47)
All dimensions in mm (inches) ±0.25 (0.010). Quantity: 15

### RECOMMENDED FOOTPRINT DETAILS




All dimensions in mm (inches) ±0.25 (± 0.010).

## 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.

These applications include but are not limited to:

- Aircraft equipment
- Aerospace equipment
- 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

Murata makes no express or implied warranty, representation, or guarantee of suitability, fitness for any particular use/purpose and/or compatibility with any application or device of the buyer, nor does Murata assume any liability whatsoever arising out of unauthorised use of any Murata product for the application of the buyer. The suitability, fitness for any particular use/purpose and/or compatibility of Murata product with any application or device of the buyer remain to be the responsibility and liability of the buyer.

Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards that anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm, and take appropriate remedial actions. Buyer will fully indemnify and hold Murata, its affiliated companies, and its representatives harmless against any damages arising out of unauthorised use of any Murata products in any safety-critical and/or life-critical applications.

Remark: Murata in this section refers to Murata Manufacturing Company and its affiliated companies worldwide including, but not limited to, Murata Power Solutions.