TEMPERATURE CHARACTERISTICS					
Parameter	Conditions	Min.	Typ.	Max.	Units
Operation	See safety approval section for UL temperature specification	-40		105	°C
Storage		-50		125	
Case temperature rise above ambient	100% Load, Nom V_{IN}, Still Air		15	22	

ABSOLUTE MAXIMUM RATINGS	
Short-circuit protection (for SELV input voltages)	Continuous
Control pin input voltage	18V Max
Lead temperature 1.0mm from case for 10 seconds (to JEDEC JESD22-B106 ISS C)	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, NCS1 12V input types	25V
Input voltage, NCS1 24V input types	40V

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 NCS1 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 NCS1 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 NCS1 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 NCS1 series has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation to a maximum case temperature of 105°C. File number E151252 applies.

The NCS1 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.

NCS1S12xxSC: 1A

NCS1S24xxSC: 0.5A

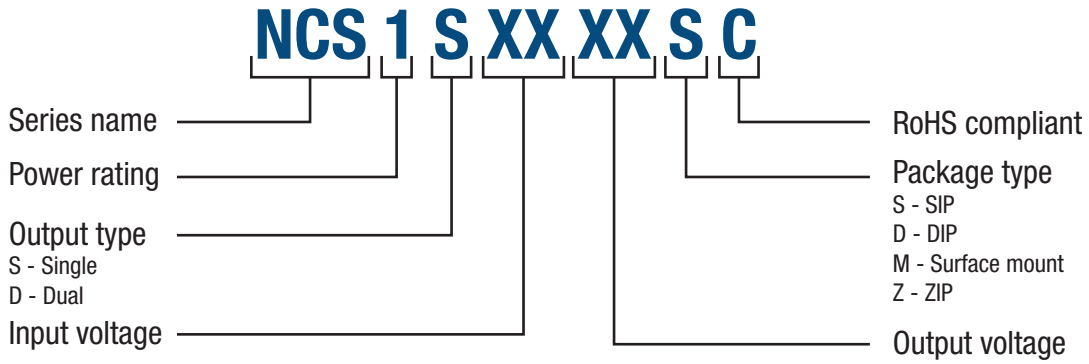
All fuses should be UL approved and rated to at least the maximum allowable DC input voltage.

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 Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems.

PART NUMBER STRUCTURE



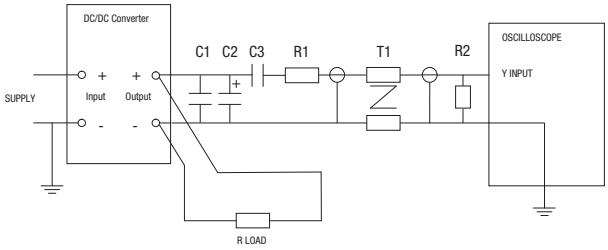
CHARACTERISATION TEST METHODS

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

Maximum Output Capacitance

Maximum output capacitance should not exceed:

Output Voltage	Maximum Load Capacitance
V	µF
3.3	470
5	470
12	220

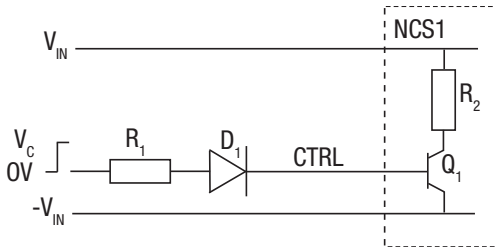
Start-up times

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 the maximum output capacitance with increased start times.

Part No.	Start-up times
	ms
NCS1S1203SC	6
NCS1S1205SC	9
NCS1S1212SC	20
NCS1S2403SC	12
NCS1S2405SC	7
NCS1S2412SC	12

Control Pin

The NCS1 converters have a shutdown feature which enables the user to put the converter into a low power state. The control pin connects directly to the base of an internal transistor, and the switch off mechanism for the NCS1 works by forward biasing this NPN transistor. If the pin is left open (high impedance), the converter will be ON (there is no allowed low state for this pin), but once a control voltage is applied with sufficient drive current, the converter will be switched OFF. A suitable application circuit is shown below.



D_1 (e.g. 1N4003) is required to provide high impedence when the signal is low. From the NCS1 specification, the drive current to operate this function is recommended to be 3mA, and hence the value of R_1 can be derived as follows:

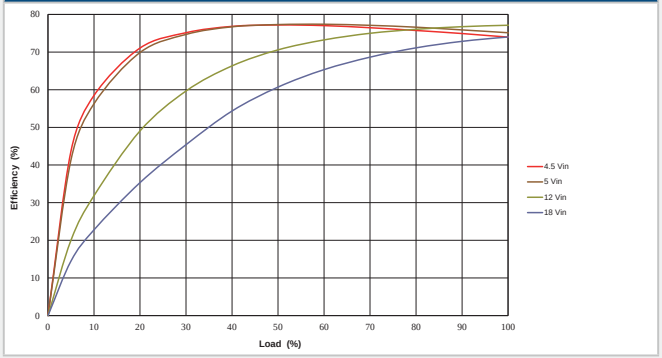
$$R_1 = \frac{V_C - V_D - V_Q}{I_C}$$

Assuming V_C=5V, V_D=0.7V and V_Q=1V:

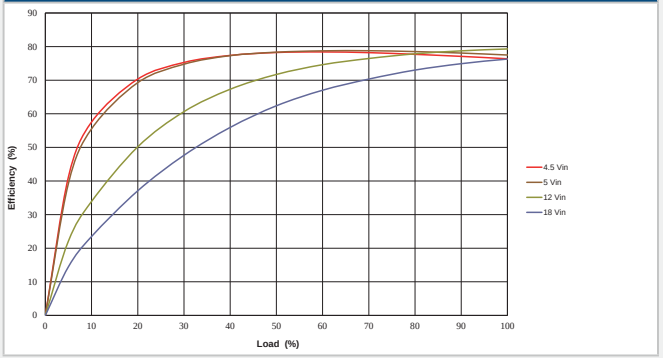
$$R_1 = \frac{5 - 0.7 - 1.0}{3 \times 10^{-3}} = 1100\Omega$$

EFFICIENCY VS LOAD

NCS1S1203SC



NCS1S1205SC



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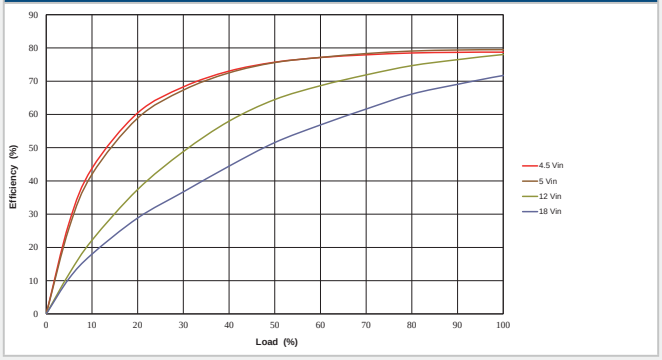

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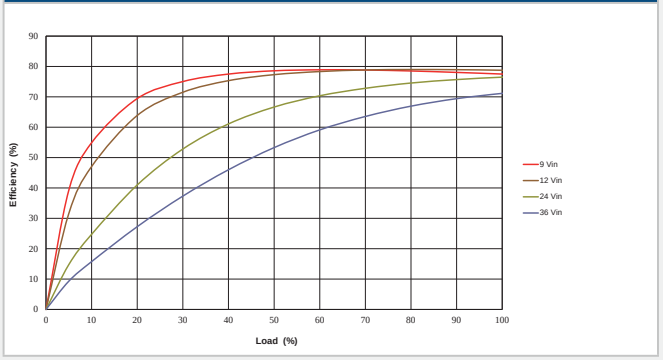

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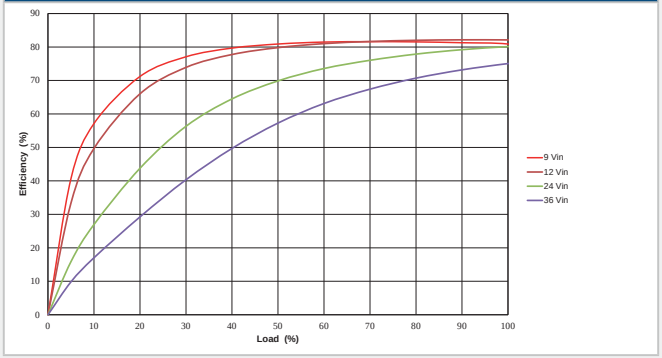

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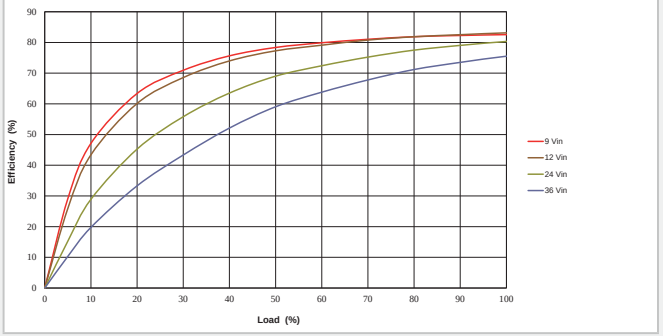
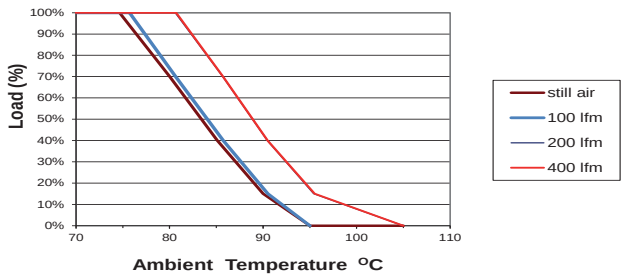


TEMPERATURE DERATING

NCS1S1203SC



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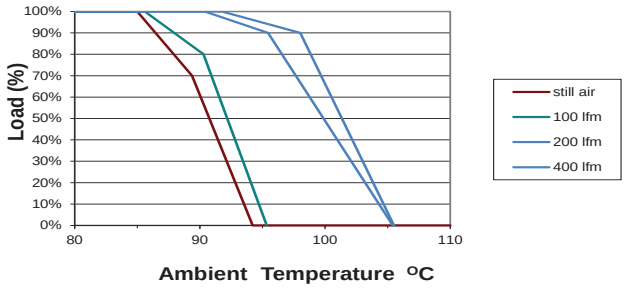

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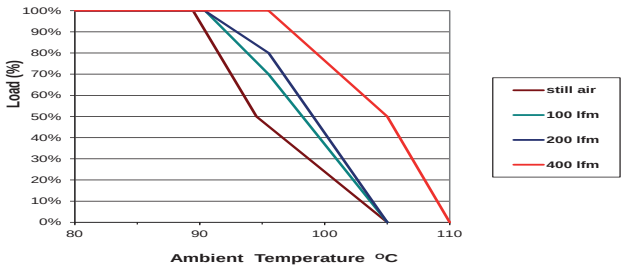

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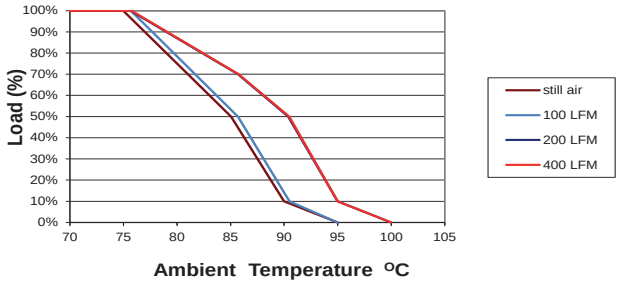

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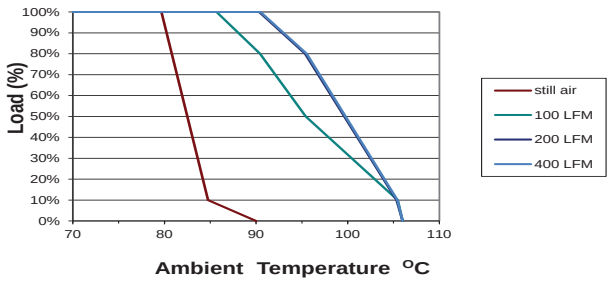

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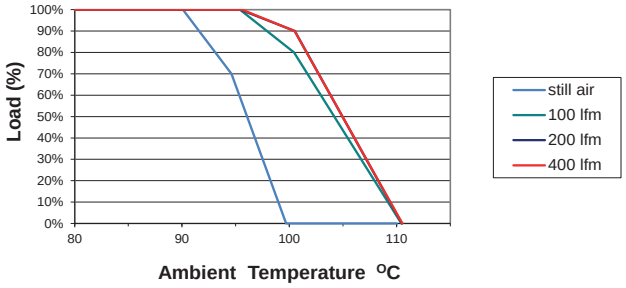


EMC FILTERING AND SPECTRA

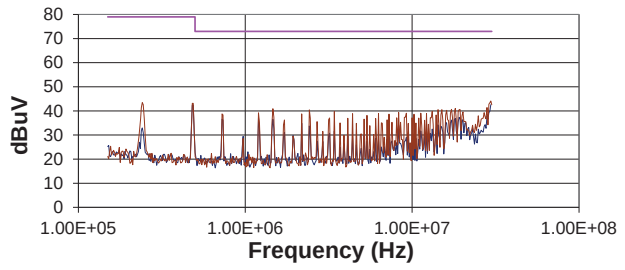
FILTERING

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

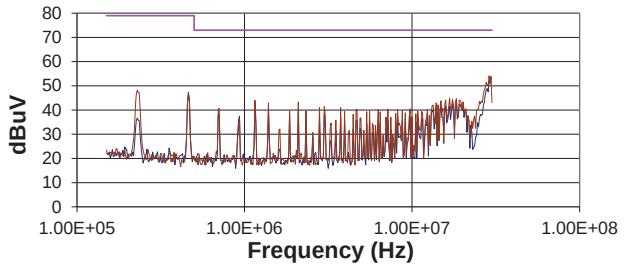
Part Number	Capacitor	Inductor	Common Mode Choke
NCS1S1203SC	330nF	500µH	
NCS1S1205SC	330nF	500µH	
NCS1S1212SC	2.2µF	2.2mH	
NCS1S2403SC	330nF	500µH	700µH
NCS1S2405SC	330nF	500µH	
NCS1S2412SC	330nF	500µH	

EMC FILTERING AND SPECTRA (Continued)

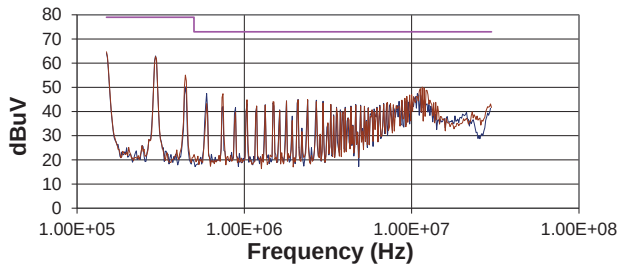
NCS1S1203SC



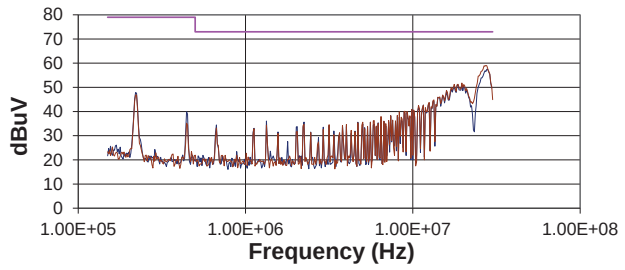
NCS1S1205SC



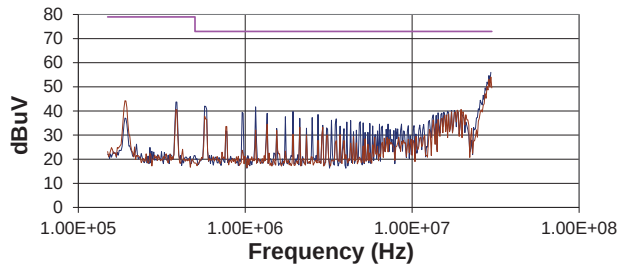
NCS1S1212SC



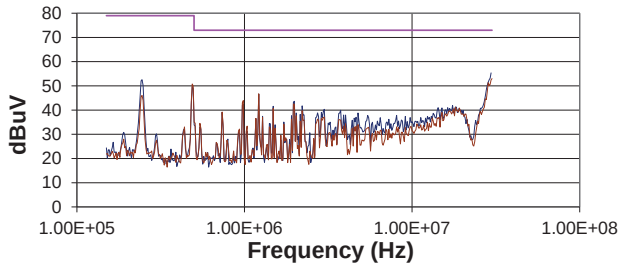
NCS1S2403SC



NCS1S2405SC

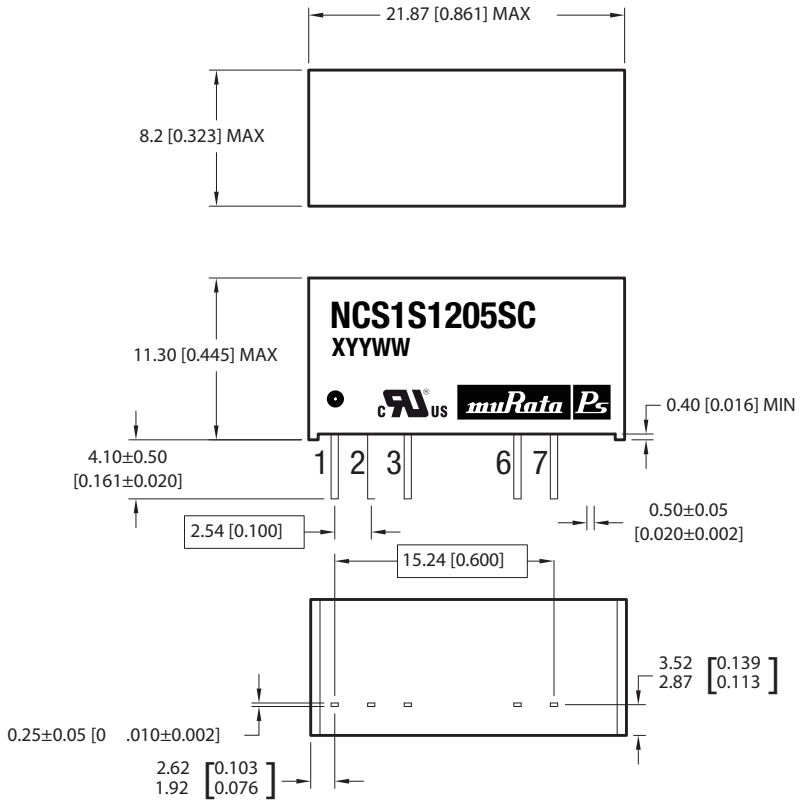


NCS1S2412SC



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



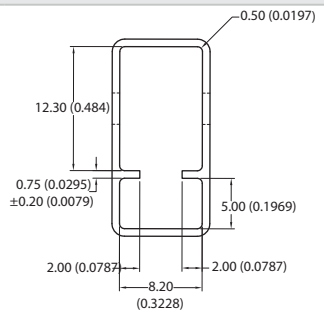
All dimensions in millimetres (inches) ± 0.5 (0.020) except pin to pin tolerance ±0.25 (0.010).
All pins on a 2.54 (0.100) pitch and within 0.25 (0.010) of true position.

Weight: 3.3g

PIN CONNECTIONS

Pin	Function
	Single
1	-V_{IN}
2	+V_{IN}
3	Control
6	+V_{OUT}
7	-V_{OUT}

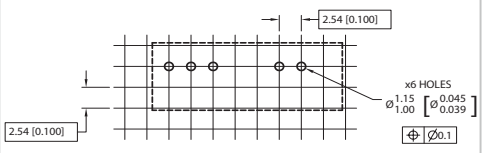
TUBE OUTLINE DIMENSIONS



All dimensions in millimetres ±0.5 (inches ±0.01).
Tube length: 520±2 (20.47 inches ±0.079).

Quantity: 23

RECOMMENDED FOOTPRINT DETAILS



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

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