



FEATURES

- UL 60950 recognised
- 4:1 wide range voltage input
- Operating temperature range -40°C to 105°C with derating
- 1kVDC isolation “Hi Pot Test”
- 3.3V, 5V & 12V outputs
- No electrolytic capacitors
- Continuous short circuit protection

PRODUCT OVERVIEW

The NCS1 series of DC-DC converters offers a single output voltage from input voltage ranges of 4.5-18V and 9-36V. The NCS1 is housed in an industry standard package with a standard pinout.

Applications include telecommunications, battery powered systems, process control and distributed power systems.

SELECTION GUIDE

Order Code	Input Voltage Nom. V	Output Voltage V	Output Current mA	Efficiency 5V or 24V Input.		Efficiency 12V Input.		Ripple and Noise		Isolation Capacitance pF	MTTF ¹ kHrs
				Min.	Typ.	Min.	Typ.	Typ.	Max.		
								mVp/p	mVp/p		
NCS1S1203SC	12	3.3	303	73	77	71	75	24	70	24	1020
NCS1S1205SC	12	5	200	76	79	74	77	25	50	30	915
NCS1S1212SC	12	12	83	75	78	75	79	40	120	35	1130
NCS1S2403SC	24	3.3	303	76	78.5	73	76	35	70	28	1217
NCS1S2405SC	24	5	200	79	82	77	80	27	50	42	1022
NCS1S2412SC	24	12	83	80	83	77	80	28	120	42	943

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	12V input types	4.5	12	18	V
	24V input types	9	24	36	
Input current	NCS1S12XX	5V input voltage	0.26		A
		12V input voltage	0.1		
	NCS1S24XX	12V input voltage	0.1		
		24V input voltage	0.05		
Input reflected ripple current	NCS1S12XX		5	30	mA p-p
	NCS1S24XX		5	15	

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated power	All output types			1	W
Minimal load to meet datasheet specification		10			%
Voltage set point accuracy	All output types		±1	±2	%
Line regulation	Low line to high line			±0.5	%
Load regulation	All output types			0.5	%
Transient response	Peak deviation (12.5-37.5% & 37.5-12.5% swing)			5	%V _{out}
	Settling time (within 5% V _{out} Nom.)		2		ms

ISOLATION CHARACTERISTICS

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

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency		100		400	kHz
Control pin input	Module on, pin unconnected or open collector floating				
	Module off			0.8	V



¹ Calculated using MIL-HDBK-217 FN2, parts stress method with nominal input voltage at full load.
All specifications typical at TA=25°C, nominal input voltage and rated output current unless otherwise specified.

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

CHARACTERISATION TEST METHODS

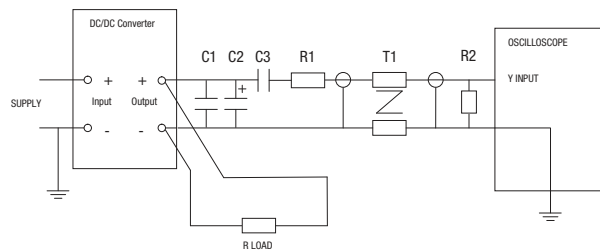
Ripple & Noise Characterisation Method

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 V	Maximum Load Capacitance μF
3.3	470
5	470
12	220

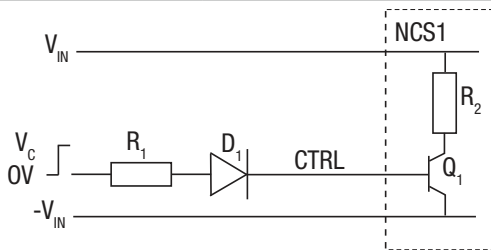
Start-up times

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.



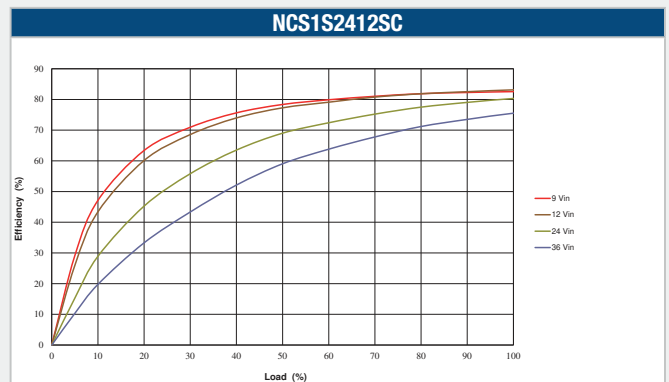
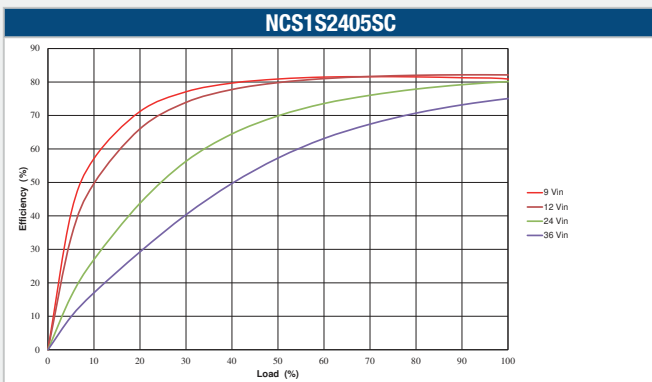
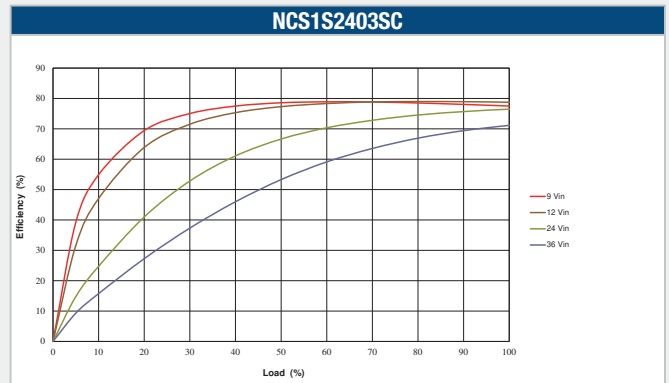
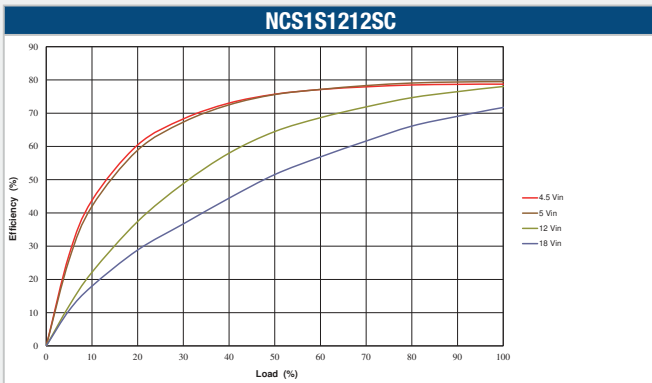
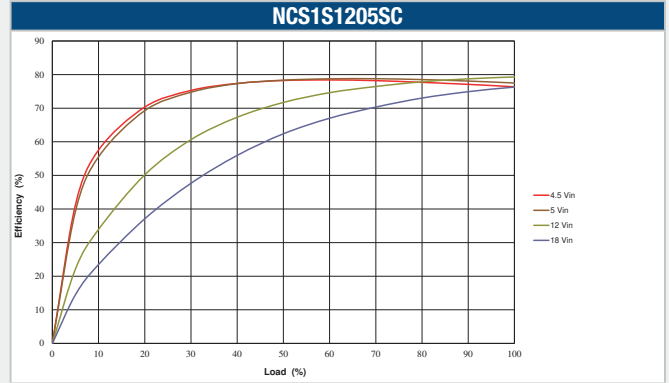
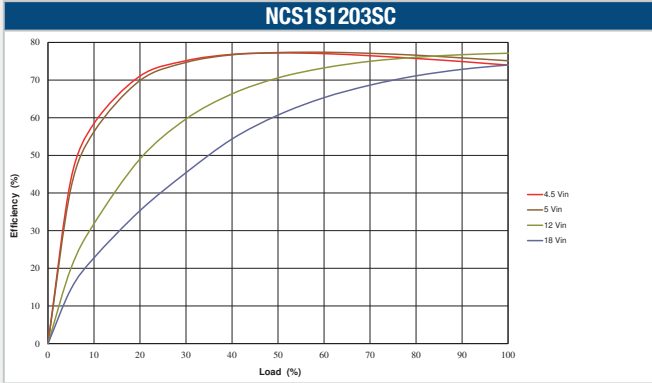
D_1 (e.g. 1N4003) is required to provide high impedance when the signal is low. From the NCS1 specification, the drive current to operate this function is recommended to be 3mA, and hence the value of R_1 can be derived as follows:

$$R_1 = \frac{V_c - V_D - V_o}{I_c}$$

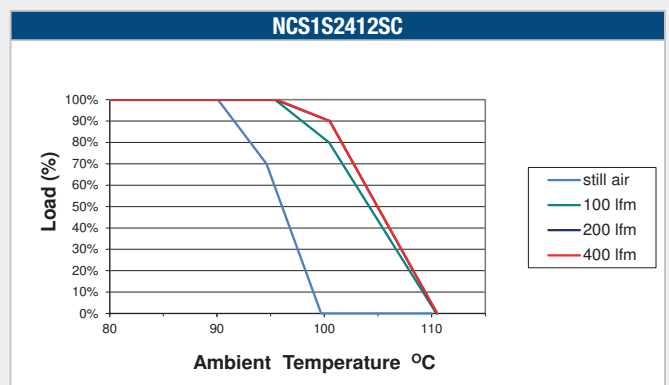
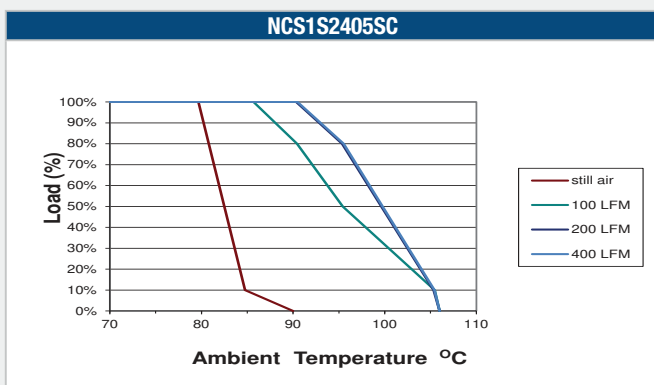
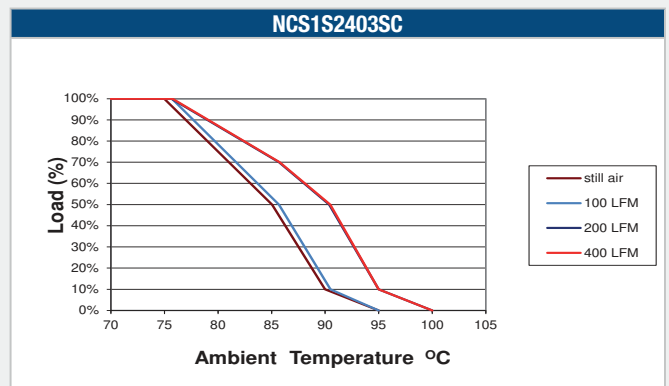
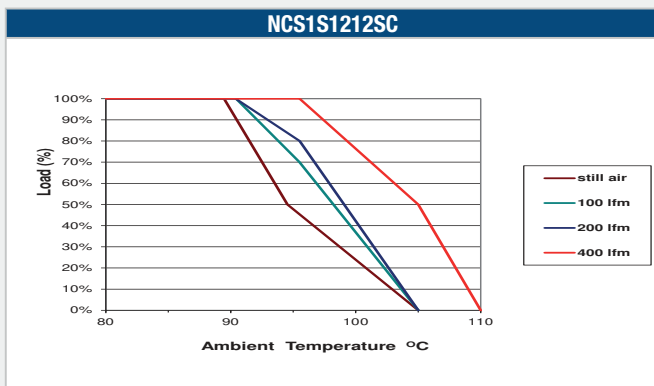
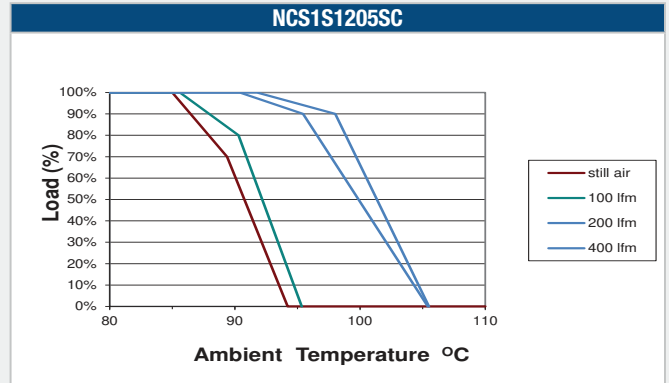
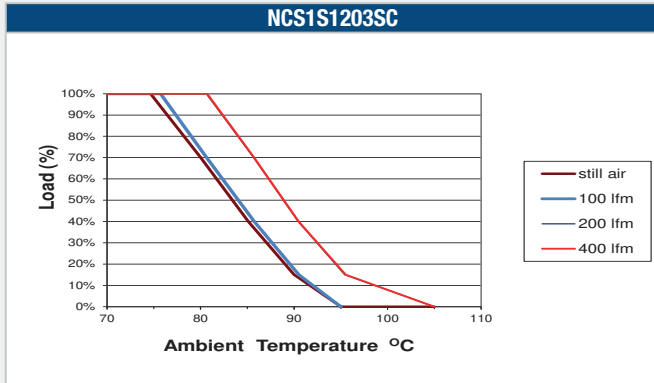
Assuming $V_c=5V$, $V_D=0.7V$ and $V_o=1V$:

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

EFFICIENCY VS LOAD



TEMPERATURE DERATING



EMC FILTERING AND SPECTRA

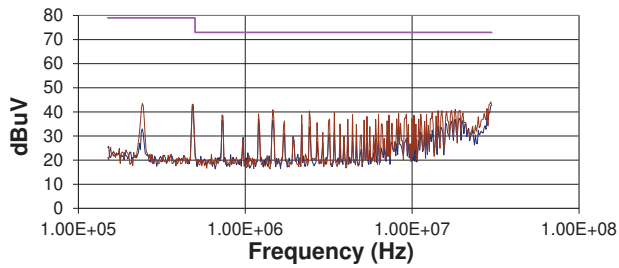
FILTERING

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.

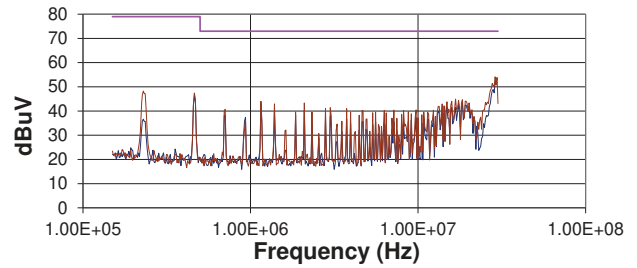
Part Number	Capacitor	Inductor	Common Mode Choke
NCS1S1203SC	330nF	500μH	
NCS1S1205SC	330nF	500μH	
NCS1S1212SC	2.2μF	2.2mH	
NCS1S2403SC	330nF	500μH	700μH
NCS1S2405SC	330nF	500μH	
NCS1S2412SC	330nF	500μH	

EMC FILTERING AND SPECTRA (Continued)

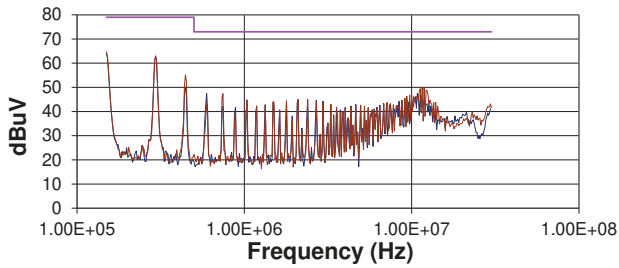
NCS1S1203SC



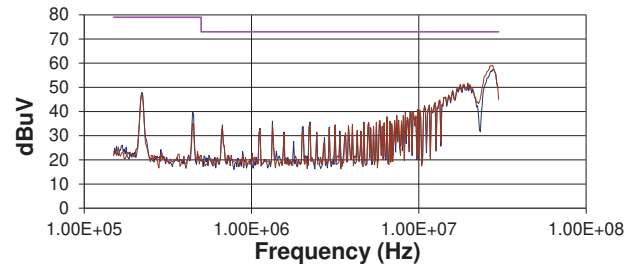
NCS1S1205SC



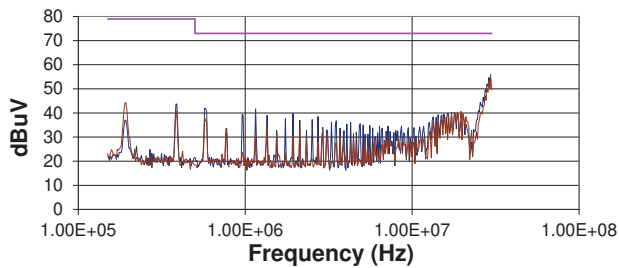
NCS1S1212SC



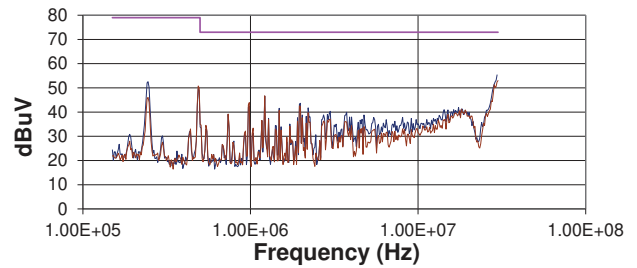
NCS1S2403SC



NCS1S2405SC

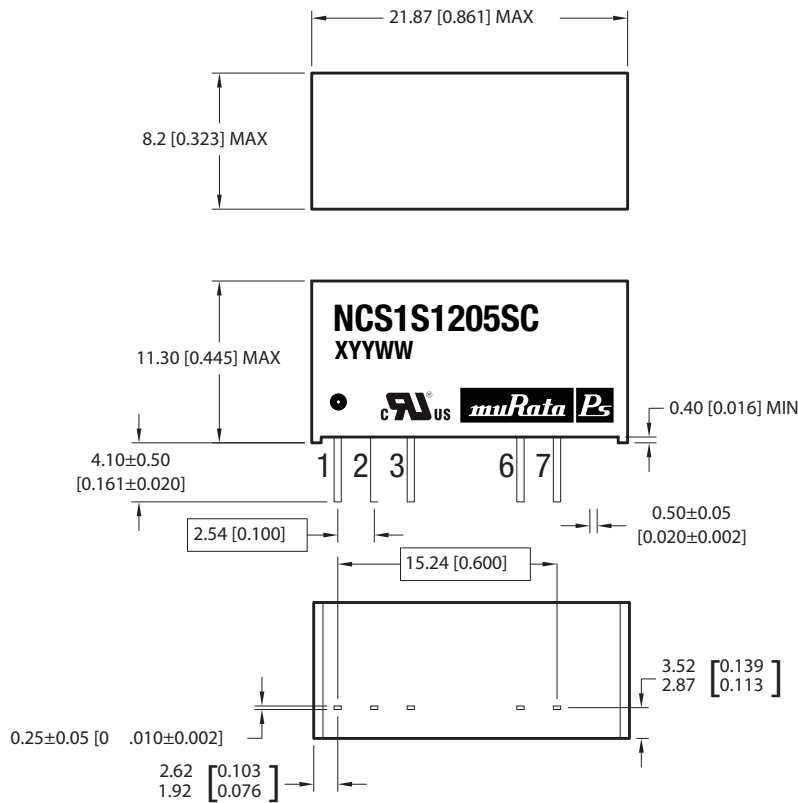


NCS1S2412SC



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



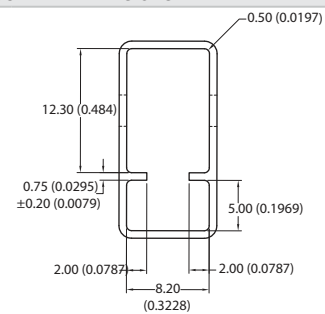
All dimensions in millimetres (inches) ± 0.5 (0.020) except pin to pin tolerance ± 0.25 (0.010).
All pins on a 2.54 (0.100) pitch and within 0.25 (0.010) of true position.

Weight: 3.3g

PIN CONNECTIONS

Pin	Function
	Single
1	-VIN
2	+VIN
3	Control
6	+VOUT
7	-VOUT

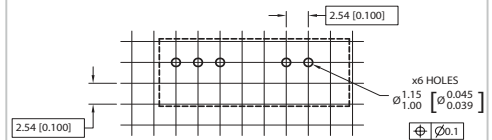
TUBE OUTLINE DIMENSIONS



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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