



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.

NCS1 Series

Isolated 1W 4:1 Input Single Output DC-DC Converters

SELECTION GUIDE

Order Code	Input Voltage	Output Voltage	Output Current	Effici 5V or 24	ency IV Input.	Effici 12V I	iency nput.	Ripple and Noise		lsolation tpacitance	MTTF ¹
	Nom.			Min.	Тур.	Min.	Тур.	Тур.	Max.	S	
	V	V	mA	%	%	%	%	mVp/p	mVp/p	pF	kHrs
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.	Тур.	Max.	Units
Vellene veren	12V input types	4.5	12	18	V	
vollage range	24V input types	9	24	36		
Input current	NOCICIONY	5V input voltage		0.26		A
	NG51512XX	12V input voltage		0.1		
	NOCICOAVY	12V input voltage		0.1		
	NG51524XX	24V input voltage		0.05		
Input reflected ripple current	NCS1S12XX			5	30	mAnn
	NCS1S24XX			5	15	шар-р

OUTPUT CHARACTERISTICS

COTFOT CHARACTERISTICS						
Parameter	Conditions	Min.	Тур.	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	%	
	Peak deviation (12.5-37.5% & 37.5-12.5% swing)			5	%V _{out}	
Transient response	Settling time (within 5% V _{out} Nom.)		2		ms	

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

GENERAL CHARACTERISTICS								
Parameter	Conditions	Min.	Тур.	Max.	Units			
Switching frequency		100		400	kHz			
Control nin 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.

www.murata.com

NCS1 Series

TEMPERATURE CHARACTERISTICS								
Parameter	Conditions		Min.	Тур.	Max.	Units		
Operation	See safety approval section for UL temperature specification				105			
Storage					125	°C		
Case temperature rise above ambient	100% Load, Nom VIN, Still Air	100% Load, Nom V _{IN} , Still Air			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 <u>application notes</u> for further information.							
Input voltage, NCS1 12V input types	25V							
Input voltage, NCS1 24V input types		40V						

NCS1 Series

Isolated 1W 4:1 Input Single Output DC-DC Converters

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



This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds. Please refer to <u>application</u> <u>notes</u> 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

NCS 1 S XX XX S C								
Series name	RoHS compliant							
Power rating	Package type							
Output type S - Single D - Dual	D - DIP M - Surface mount Z - ZIP							
Input voltage ————	Output voltage							

NCS1 Series

Isolated 1W 4:1 Input Single Output DC-DC Converters

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 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 C2 than $100m\Omega$ at 100 kHzC3 100nF multilayer ceramic capacitor, general purpose R1 450Ω resistor, carbon film, $\pm1\%$ 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** DC/DC Converter OSCILLOSCOPE C1 C2 C3 R2 R1 Y INPUT + Outpu 0 R LOAD

NCS1 Series

	e should not exceed:	
Output Voltage	Maximum Load Capacitance	
V	μF	
3.3	470	
5	470	
12	220	
art-up times		
Typical start up times for this start into the maximum outpu	series, with a typical input voltage rise time of 2. It capacitance with increased start times.	$2\mu s$ and output capacitance of $10\mu F$ are shown in the table below. The product series will
Dort No.	Start-up times	
Fait NU.	ms	
NCS1S1203SC	6	
NCS1S1205SC	9	
NCS1S1212SC	20	
NCS1S2403SC	12	
NCS1S2405SC	7	
NCS1S2412SC	12	
ntrol Pin e NCS1 converters have a sh	nutdown feature which enables the user to put th	e converter into a low power state. The control pin connects directly to the base of an inte
ntrol Pin e NCS1 converters have a sh nsistor, and the switch off m allowed low state for this pi low.	nutdown feature which enables the user to put th echanism for the NCS1 works by forward biasing n), but once a control voltage is applied with suffi	e converter into a low power state. The control pin connects directly to the base of an inte this NPN transistor. If the pin is left open (high impedance), the converter will be ON (ther cient drive current, the converter will be switched OFF. A suitable application circuit is sho
Nontrol Pin le NCS1 converters have a sh unsistor, and the switch off m allowed low state for this pin low. V _{IN} V _C R ₁ OV -V _{IN}	hutdown feature which enables the user to put the echanism for the NCS1 works by forward biasing n), but once a control voltage is applied with suffi	e converter into a low power state. The control pin connects directly to the base of an inte this NPN transistor. If the pin is left open (high impedance), the converter will be ON (ther cient drive current, the converter will be switched OFF. A suitable application circuit is sho 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 follow $R_1 = \frac{V_c - V_0 - V_0}{I_c}$ Assuming V_c =5V, V_p =0.7V and V_0 =1V: $R_1 = \frac{5 - 0.7 - 1.0}{3 \times 10^{-3}} = 1100\Omega$

NCS1 Series



NCS1 Series



NCS1 Series

Isolated 1W 4:1 Input Single Output DC-DC Converters

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	

NCS1 Series



NCS1 Series



NCS1 Series

Isolated 1W 4:1 Input Single Output DC-DC Converters

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.



This product is subject to the following <u>operating requirements</u> and the <u>Life and Safety Critical Application Sales Policy</u>: Refer to: https://www.murata.com/en-eu/products/power/requirements

Murata Power Solutions (Milton Keynes) Ltd. makes no representation that the use of its products in the circuits described herein, or the use of other technical information contained herein, will not infringe upon existing or future patent rights. The described herein do not imply the granting of licenses to make, use, or sell equipment constructed in accordance therewith. Specifications are usibler to change without notice. *© 2021 Murata Power Solutions (Milton Keynes) Ltd.*