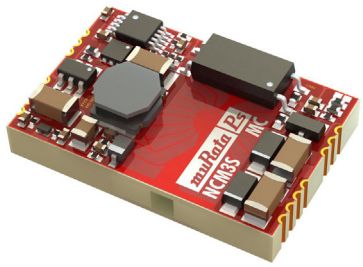
NCM3 Series

Isolated 3W 4:1 Input Single Output DC-DC Converters



FEATURES

- Patent protected
- Manufactured in the UK
- UL62368-1 recognised
- ANSI/AAMI ES60601-1, 2 MOPP pending recognition
- 4:1 wide range voltage input
- <1uA leakage current
- Operating temperature range -40°C up to 105°C with derating
- 5kVAC Isolation 'Hi Pot Test'
- No electrolytic capacitors
- Continuous short circuit protection

PRODUCT OVERVIEW

The NCM3 series of DC-DC converters supports single output voltages from a 4:1 input voltage range of 9-36V. The NCM3 with UL62368-1 250Vrms reinforced insulation and ANSI/AAMI ES60601-1 pending for 2 MOPP provides mains safety isolation for both medical and other high voltage applications.

The SMD package enables high speed automated product placement with an operating ambient temperature range from -40°C to 105°C with derating.

SELECTION GUIDE

Order Code[1]	Input Voltage	Output Voltage	Rated Input Current		Output Current	Efficiency				Ripple and Noise[2]		Isolation Capacitance
	Nom.		12V	24V		12V Input		24V Input				
	V	V	mA		mA	Min. %	Typ. %	Min. %	Typ. %	Typ. mVp/p	Max. mVp/p	pF
NCM3S1205MC	12	5	360	190	600	65	68	63	66	50	80	3
NCM3S1212MC	12	12	330	170	250	72	76	70	74	30	60	3
NCM3S1224MC	12	24	330	170	125	71	75	70	74	30	60	3

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range		9	12	36	V
Input reflected ripple current			5		mA p-p
Leakage current	250VAC/60Hz		<1		µA

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated power	All other output types			3	W
Voltage set point accuracy	All output types		±2		%
Line regulation	Low line to high line		0.1	0.5	%
Load regulation	All output types		0.1	0.5	%
Transient Response - Peak Deviation (25%-75% & 75%-25% swing)	NCM3S1205MC		8		%Vout
	NCM3S1212MC		4		
	NCM3S1224MC		2		
Transient Response - Settling time	NCM3S1205MC		0.3		ms
	NCM3S1212MC		1		
	NCM3S1224MC		1.5		

ISOLATION CHARACTERISTICS

Parameter		Conditions		Min.	Typ.	Max.	Units
Isolation test voltage		Production tested for 1 second		5000			VAC
		Qualification tested for 1 minute		5000			
Resistance		Viso = 1kVDC		1			GΩ
Safety standard	UL62368-1	Reinforced	Creepage and clearance 8mm			250	Vrms
	ANSI/AAMI ES60601-1[3]	2 MOPP				250	

GENERAL CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Switching frequency	Nominal voltage 12V and 24V	NCM3S1205MC		200		kHz
		NCM3S1212MC		230		
		NCM3S1224MC		260		

1. Components are supplied in tape and reel packaging, please refer to package specification section. Orderable part numbers are NCM3SXXXXMC-R7 (100 pieces per reel), or NCM3SXXXXMC-R13 (420 pieces per reel).
2. See ripple and noise test method.
3. ANSI/AAMI ES60601-1 recognition is currently pending.

All specifications typical at TA=25°C, nominal input voltage and rated output current unless otherwise specified.

RoHS COMPLIANT

For full details go to https://www.murata.com/en-global/products/power/rohs

GENERAL CHARACTERISTICS (Continued)

Parameter	Conditions			Min.	Typ.	Max.	Units
MTTF	MIL-HDBK-217	Nominal 12V	NCM3S1205MC			1028	kHrs
			NCM3S1212MC			1058	
			NCM3S1224MC			1085	
		Nominal 24V	NCM3S1205MC			1033	
			NCM3S1212MC			1176	
			NCM3S1224MC			1002	
	Telecordia SR-332	Nominal 12V	NCM3S1205MC			3489	
			NCM3S1212MC			6189	
			NCM3S1224MC			4293	
		Nominal 24V	NCM3S1205MC			3637	
			NCM3S1212MC			6208	
			NCM3S1224MC			3038	

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Operation	See derating graphs	-40		105	°C
Storage		-55		125	
Product temperature rise above ambient	NCM3S1205MC		26		
	NCM3S1212MC		21		
	NCM3S1224MC		17		
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS

Input voltage, 12V input types	40V
Short-circuit protection	Continuous

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 NCM3 series of DC-DC converters are all 100% production tested at 5kVAC for 1 second and have been qualification tested at 5kVAC for 1 minute

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

The NCM3 has been recognised by Underwriters Laboratory for reinforced insulation to a working voltage of 250Vrms.

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 NCM3 series has a PCB embedded isolated transformer, using FR4 as an insolation barrier between primary and secondary windings. While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the FR4 insulation properties. Any material, including FR4 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 should be reduced by 20% from specified test voltage.

This consideration equally applies to agency recognised parts rated for better than functional isolation where the insulation is always supplemented by a further insulation system of physical spacing or barriers.

SAFETY APPROVAL

ANSI/AAMI ES60601-1

The NCM3 series is pending recognition by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 2 MOPP (Mean Of Patient Protection) based on a working voltage of 250Vrms.

UL62368-1

The NCM3 series is recognised by Underwriters Laboratory (UL) to UL62368 for reinforced insulation to a working voltage of 250Vrms.

FUSING

The NCM3 Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.
Input Voltage, 12V: 1A

All fuses should be UL recognised and suitably rated to meet application requirements.

RoHS COMPLIANCE INFORMATION

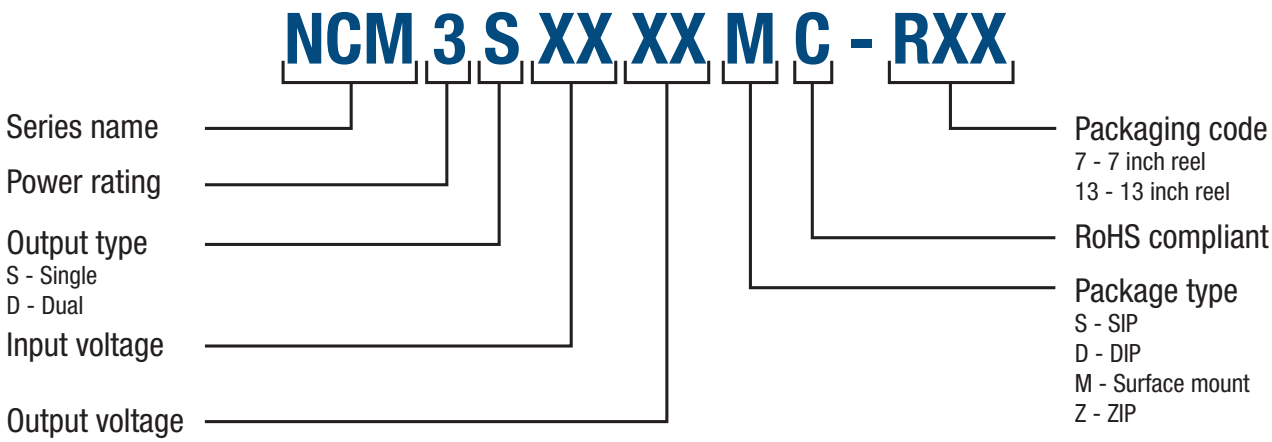
This series is compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems.
The NCM3 series can be soldered in accordance with J-STD-020 and have a classification temperature of 260°C and moisture sensitivity level 2. The termination finish on this product is ENIG with plating thickness 0.05 microns (min) as per IPC-4552.
For further information, please visit: www.murata.com/en-global/products/power/rohs

ENVIRONMENTAL VALIDATION TESTING

The following tests have been conducted on this product series, as part of our design verification process. The datasheet characteristics specify user operating conditions for this series, please contact Murata if further information about the tests is required.

Test	Standard	Condition
Temperature cycling	JEDEC JESD22-A104	1000 cycles between two temperature extremes set to achieve -40°C and +105°C. 2 full cycles per hour.
Humidty Bias	JEDEC JESD22-A101	1000 hours at 85°C ± 2°C, 85% ± 5% R.H.
High temperature Storage life	JEDEC JESD22-A103	1000 hours at 125°C (-0/+10)°C.
MSL	IPC/JEDEC J-STD-020	Bake samples at 125 +5/-0°C for 24 hours minimum before conditioning in the Temperature/Humidity chamber for 168 hours 85ºC/60%RH.
Solderability	Based on IPC/ECA J-STD-002, Test B1	Pb-free (Test B1) For lead free solderability the parts are baked in an oven for 4 hours ± 15 min. at a temperature of 155±5°C. Dipped in solder at 245°C ±5°C for 5 +0/-0.5 seconds.

PART NUMBER STRUCTURE



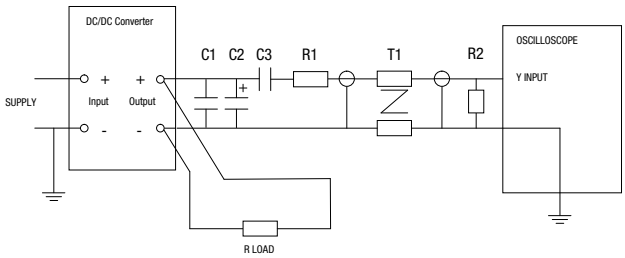
CHARACTERISATION TEST METHODS

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

Recommended maximum output capacitance

A 10 µF output capacitor is recommended for stability under all operating conditions. Maximum output capacitance should not exceed:

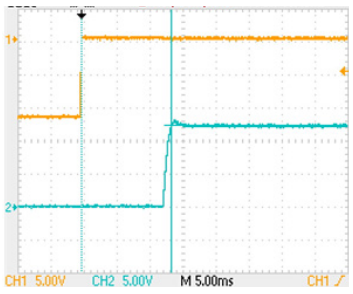
Output Voltage	Maximum Load Capacitance
V	µF
5	680
12	150
24	68

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.

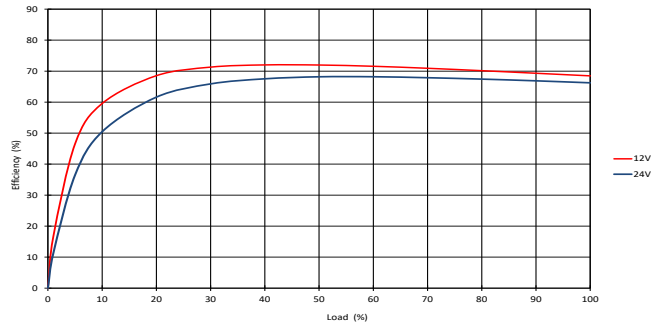
Part No.	Start-up times
	ms
NCM3S1205MC	12
NCM3S1212MC	13
NCM3S1224MC	18

Typical Start-Up Wave Form

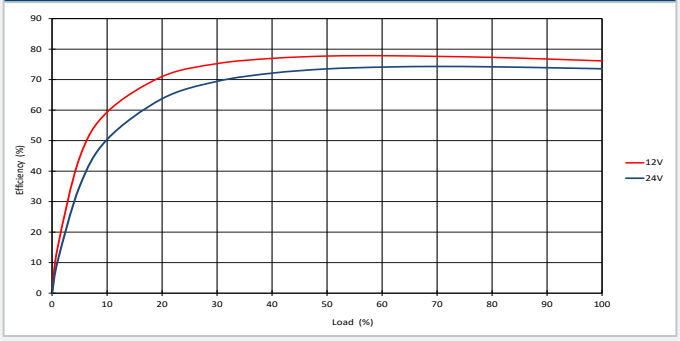


EFFICIENCY VS LOAD

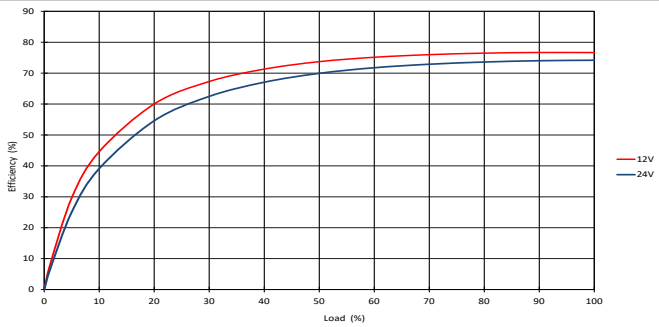
NCM3S1205MC



NCM3S1212MC

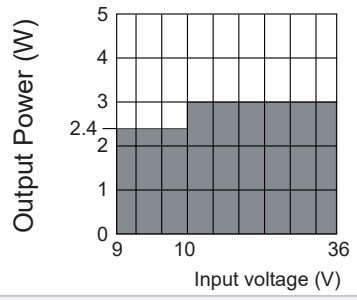


NCM3S1224MC

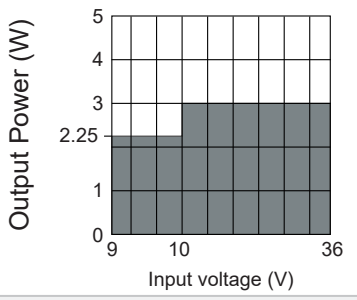


POWER DERATING

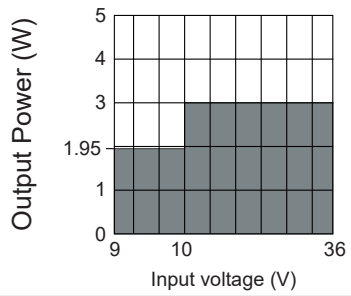
NCM3S1205MC



NCM3S1212MC

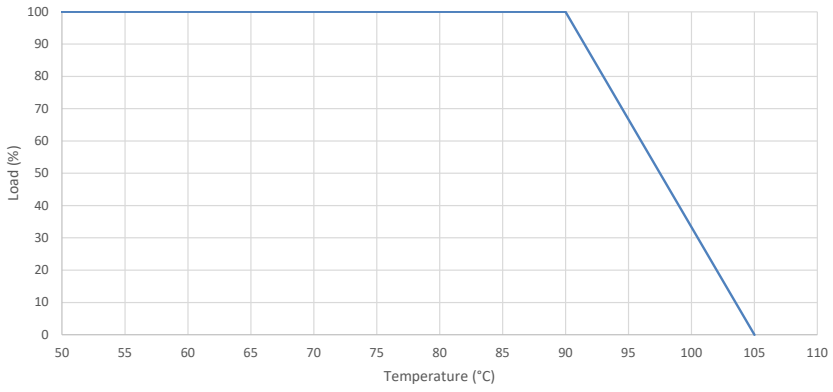


NCM3S1224MC



TEMPERATURE DERATING

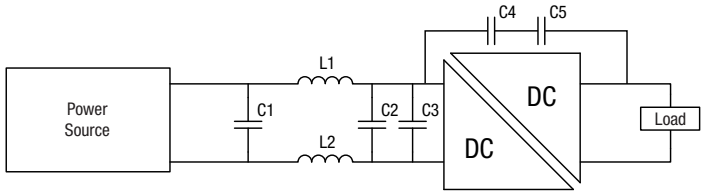
NCM3S12XXMC



EMC FILTERING AND SPECTRA

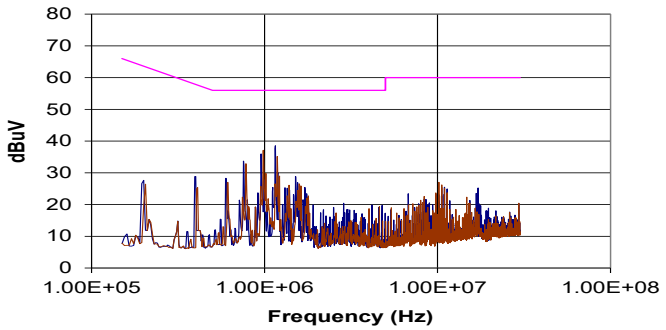
FILTERING

An input capacitor and inductor is required to meet EN 55032 Curve B, Quasi-Peak EMC limit, as shown in the following plots. The following plots show positive and negative quasi peak and CISPR22 Average Limit B (green line) and Quasi Peak Limit B (pink line) adherence limits. Filter suitability should be evaluated in application.

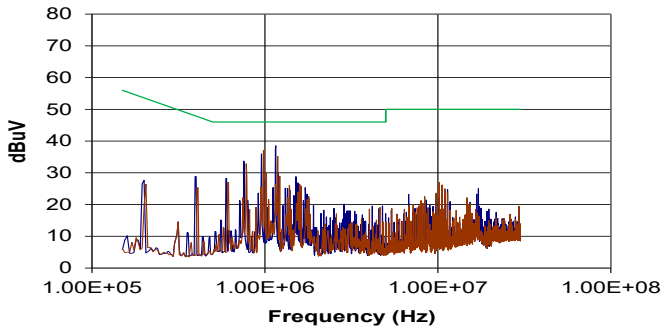


	Inductor		Capacitor				
	L1 & L2, µH	SMD	C1 & C2, µF	SMD	C3, pF	C4 & C5 pF	SMD
NCM3S1205MC	22	LQH5BPH220MT0	22	KRM55QR71H226KH13	220	470	DK1B3EA471K86HAH01
NCM3S1212MC	22	LQH5BPH220MT0	22	KRM55QR71H226KH13	220	220	DK1B3EA221K86HAH01
NCM3S1224MC	22	LQH5BPH220MT0	22	KRM55QR71H226KH13	220	2200	DK1F3EA222M86HAH01

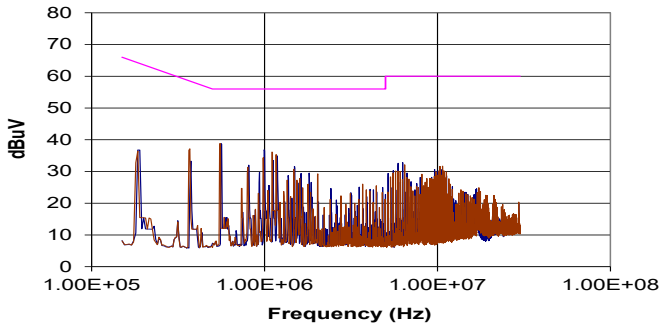
NCM3S1205MC (Quasi-Peak)



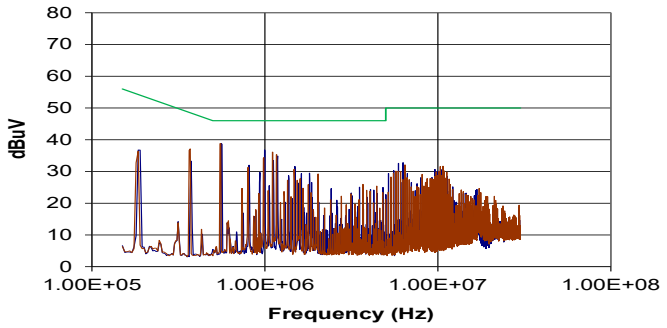
NCM3S1205MC (Average)



NCM3S1212MC (Quasi-Peak)

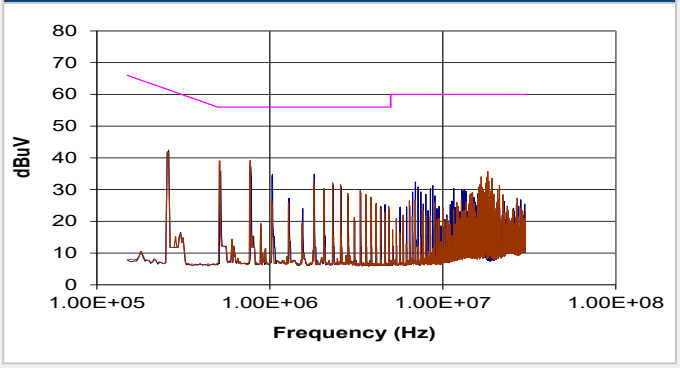


NCM3S1212MC (Average)

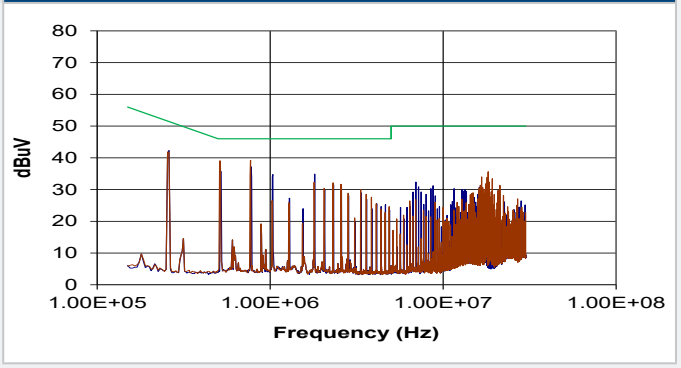


EMC FILTERING AND SPECTRA (Continued)

NCM3S1224MC (Quasi-Peak)

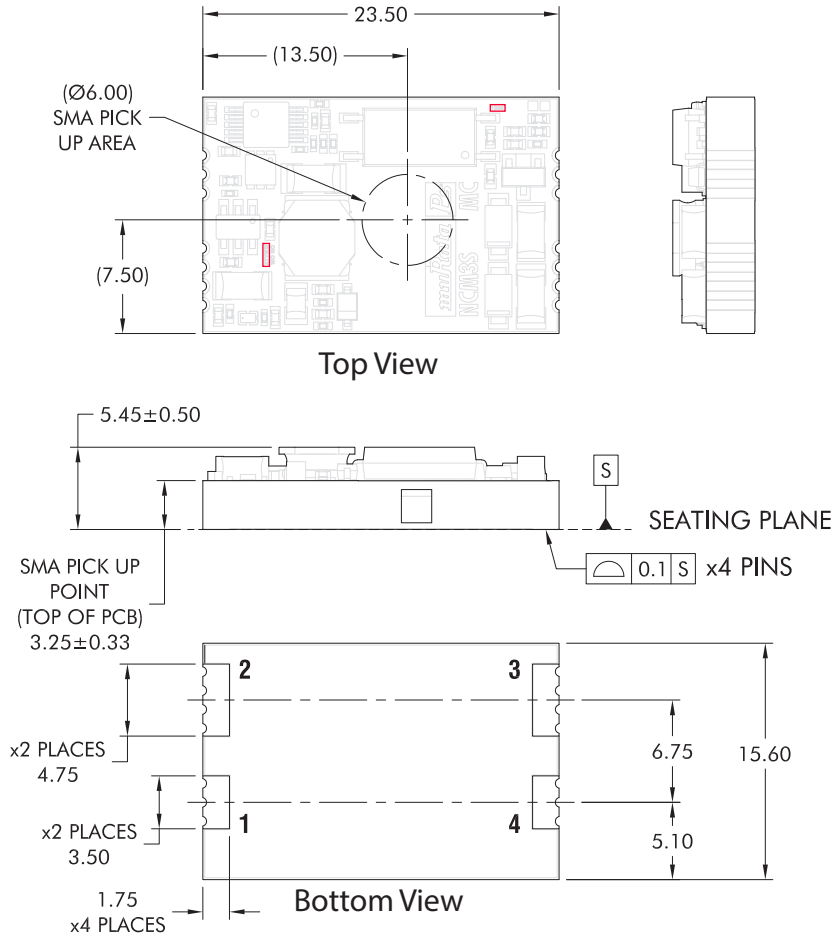


NCM3S1224MC (Average)



PACKAGE SPECIFICATIONS

Mechanical Dimensions



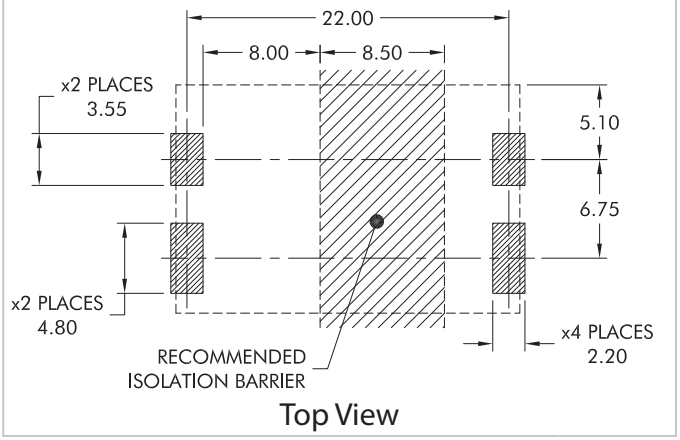
All dimensions in mm, Tolerances (unless otherwise stated) ±0.2.
Part number and date code are highlighted with a red box on the
Components shown for reference only

Weight: 3.4g

Pin Connections

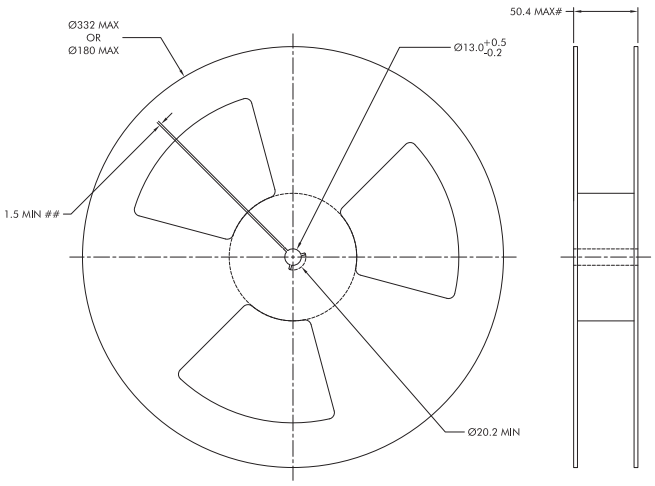
Pin	Function
1	-Vin
2	+Vin
3	+Vout
4	-Vout

Recommended Footprint Details



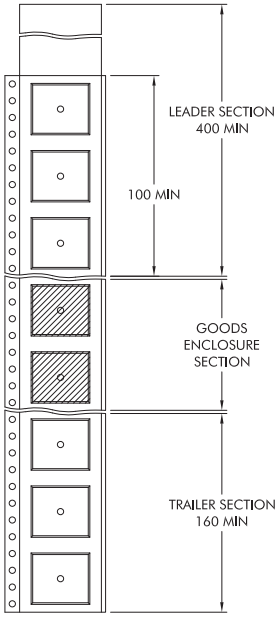
TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS



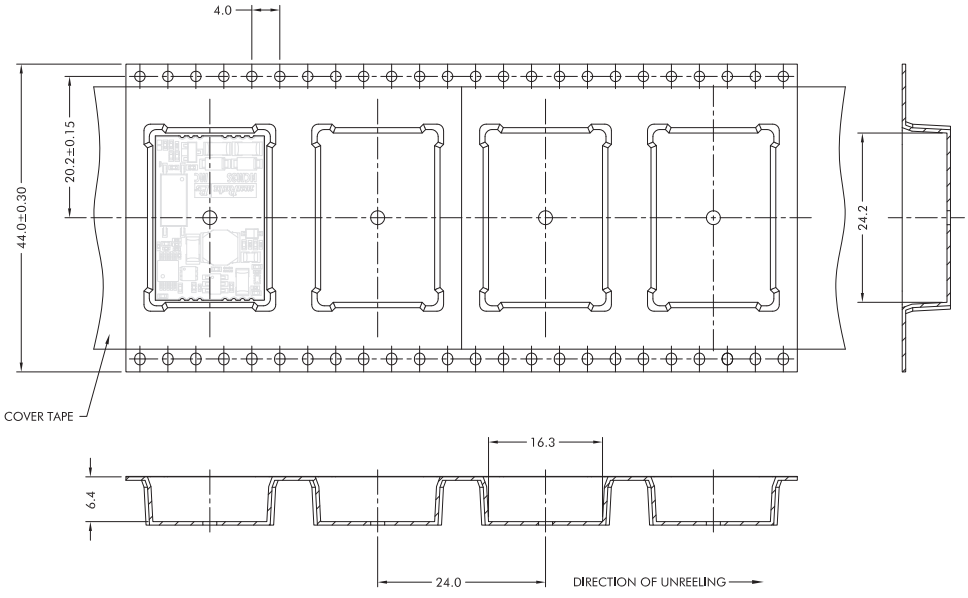
All dimensions in mm.
Measured at hub
Six equi-spaced slots on 178mm reel
13.5±0.3mm on 178mm reel

REEL PACKAGING DETAILS



Reel Quantity: 7" - 100 or 13" - 420
Carrier tape pockets shown are illustrative only - Refer to carrier tape diagram for actual pocket details.

TAPE OUTLINE DIMENSIONS



Carrier tape specification shall conform with current EIA-481 standard
Unless otherwise stated all dimensions in mm ±0.1mm.
Components shall be orientated within the carrier tape as indicated

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

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