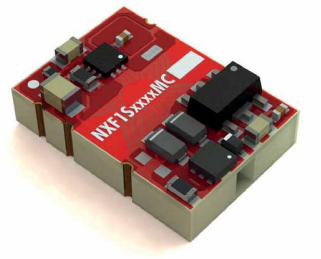
Murata Power Solutions

NXF1 Series

Isolated 1W Regulated Single Output DC-DC Converters



FEATURES

- Reinforced insulation to UL62368-1 recognised
- ANSI/AAMI ES60601-1, 2 MOOP & 1 MOPP recognised
- Output regulation <1%
- Single isolated output
- 3kVDC isolation 'Hi-Pot Test'
- 3.3V & 5V inputs
- 3.3V & 5V outputs
- SMD construction
- Patent protected
- Short circuit protection

DESCRIPTION

The NXF1 series of DC-DC converters is used where a tightly regulated supply is required. They are ideal for situations where the input voltage is not tightly controlled. The single rail regulated output makes the ideal choice to power sensors, such as pressure transducers, hall effect sensors and mass airflow sensors.

SELECTION GUIDE

Order Code[1]	Nominal Input Voltage	Output Voltage	Output Current	Ripple & Noise (Typ.)	Ripple & Noise (Max.)	Input Current (Typ.)	Efficiency (Min.)	Efficiency (Typ.)	Isolation Capacitance	MTTF[2]	
	V	V	mA	mVp-p		mA	%	%	pF	kHrs MIL	kHrs TEL
NXF1S0303MC	3.3	3.3	303	10	30	510	56	59	3	1093	9499
NXF1S0305MC	3.3	5	200	15	40	510	55.5	59	3	1053	11148
NXF1S0505MC	5	5	200	15	40	310	56	62	3	937	14652

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 3.3V input types	3.135	3.3	3.465	V
	Continuous operation, 5V input types	4.75	5	5.25	
Reflected ripple current	3.3V Input types		15		mA p-p
	5V Input types		5		

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	NXF1S0303MC		90		kHz
	NXF1S0305MC		106		
	NXF1S0505MC		120		

OUTPUT CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Voltage set point accuracy	3.3V Output			±1		%
	5V Output			±2		
Rated power	T_A= -40°C to 85°C				1	W
Line regulation	High VIN to low VIN	3.3V Output		0.03	0.1	%/%
		5V output		0.01	0.1	
Load regulation (10% load to rated load)	3.3V output types			0.5	1	%
	5V output types			0.4	1	

ISOLATION CHARACTERISTICS

Parameter		Conditions		Min.	Typ.	Max.	Units
Isolation test voltage		Production tested for 1 second		3000			VDC
		Qualification tested for 1 minute		3300			
Resistance		Viso= 1kVDC		10			GΩ
Safety standard	UL62368-1	Reinforced	Creepage and clearance 3mm			125	Vrms
		Basic				250	
	ANSI/AAMI ES60601-1	2 MOOP, 1 MOPP				125	
		1 MOOP				250	

RoHS COMPLIANT

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

c UL us

1. Components are supplied in tape and reel packaging, please refer to package specification section. Orderable part numbers are NXF1SXXXXMC-R7 (160 pieces per reel), or NXF1SXXXXMC-R13 (740 pieces per reel).
2. Calculated using MIL-HDBK-217F with nominal input voltage at full load.

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

TEMPERATURE CHARACTERISTICS						
Parameter	Conditions		Min.	Typ.	Max.	Units
Specification	See derating graphs	3.3V Input types	-40		90	°C
		5V input types	-40		105	
Storage			-50		125	
Product temperature above ambient	3.3V input types			36		
	5V input type			28		
Cooling	Free air convection					

ABSOLUTE MAXIMUM RATINGS	
Short-circuit protection	Continuous and auto recovery
Input voltage V_{IN}, NXF1S03 types	4V
Input voltage V_{IN}, NXF1S05 types	7V

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 NXF1 series of DC-DC converters are all 100% production tested at 3kVDC for 1 second and has been qualification tested at 3.3kVDC for 1 minute.

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

The NXF1 series is recognised by Underwriters Laboratory to 125Vrms Reinforced Insulation and 250Vrms Basic insulation, please see safety approval section below.

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 NXF1 series has a PCB embedded isolated transformer, using FR4 as an insulation 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 NXF1 series is recognised by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 2 MOOP (Means Of Operator Protection) and 1MOPP (Means of patient protection) based upon a working voltage of 125Vrms and 1 MOOP (Means Of Operator Protection) based upon a working voltage of 250Vrms max, between Primary and Secondary.

UL62368-1

The NXF1 series is recognised by Underwriters Laboratory (UL) to UL62368-1 for reinforced insulation to a working voltage of 125Vrms and for basic insulation to a working voltage of 250Vrms.

File number E151252 applies.

Creepage and clearance is 3mm
Working altitude 5000m
Over voltage category (OVC) II

FUSING

The NXF1 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, 3.3V: 2.5A
Input voltage, 5V: 2.5A

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

RoHS COMPLIANCE INFORMATION

This series is compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems. The NXF1 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 Gold with plating thickness 0.12 microns.

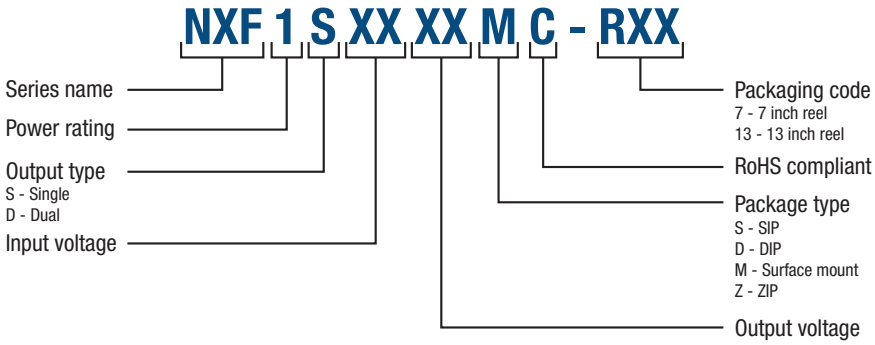
For further information please visit www.murata.com/en-global/products/power/rohs

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	MIL-STD-883 Method 1010, Condition B	10 cycles between two chambers set to achieve -55°C and +125°C. The dwell time shall not be less than 10min and the load shall reach the specified temperature in 15min.
Humidity bias	JEDEC JESD22-A101	85°C ± 2°C, 85% ± 5% R.H. for >1000 hours.
High temperature storage life	JEDEC JESD22-A103, Condition A	125°C +10/-0°C for ≥1000 hours.
Vibration	BS EN 61373 with respect to BS EN 60068-2-64, Test Fh Category 1 Class B	5 – 150Hz. Level at each axis – Vertical, Traverse and Longitudinal: 5.72m/s^2 rms. 5 hours in each axis. Crest factor: 3 Sigma. Device is secured by pads.
Shock	BS EN 61373, Category 1 Class B	Test is 30ms duration, 3 shocks in each sense of 3 mutually perpendicular axes (18 shocks total). Level at each axis as follows: Vertical, Traverse and Longitudinal: 50m/s^2. Device is secured by pads.
Solvent cleaning	Resistance to cleaning agents.	Solvent – Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion 45°C- 65°C
Solvent Resistance	MIL-STD-883 Method 2015	The parts and the bristle portion of the brush are immersed in Isopropanol for a minimum of 1 minute. The parts are brushed 3 times, after the third time the parts are blown dry and inspected.

PART NUMBER STRUCTURE



APPLICATION NOTES

Short Circuit Performance

The NXF1 series short circuit protection is continuous and all variants will auto restart under all datasheet operating conditions after a short circuit.

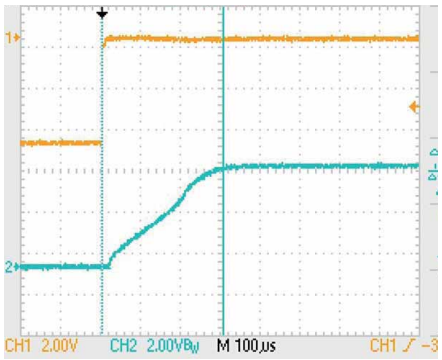
Capacitive loading and start up

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. In most applications an output capacitance is 10µF is usually sufficient, the maximum allowable output capacitance is as follows.

Output Voltage (V)	Maximum Output Capacitance (µF)
3.3	33
5	47

	Start-up time
	ms
NXF1S0303MC	0.35
NXF1S0305MC	0.24
NXF1S0505MC	0.28

NXF1S0505MC



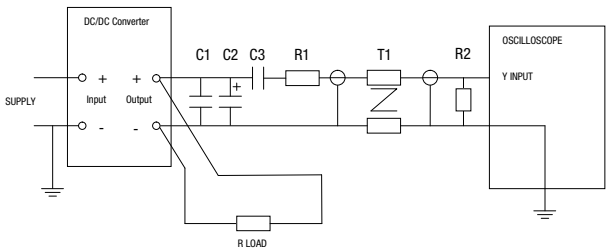
APPLICATION NOTES

Ripple & Noise Characterisation Method

Ripple and noise measurements are performed with the following test configuration.

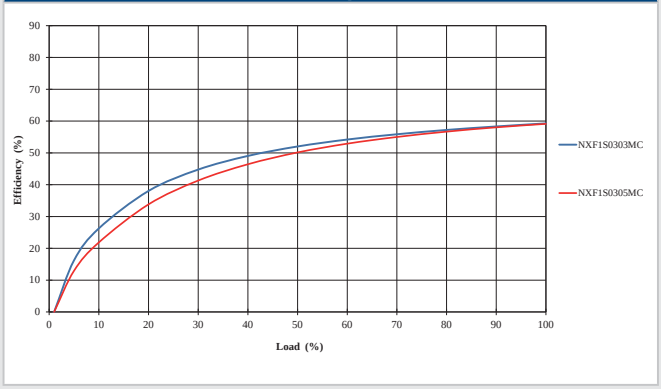
C1	1µF X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC-DC converter
C2	10µF tantalum capacitor, voltage rating to be a minimum of 1.5 times the output voltage of the DC-DC converter with an ESR of less than 100mΩ at 100 kHz
C3	100nF multilayer 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

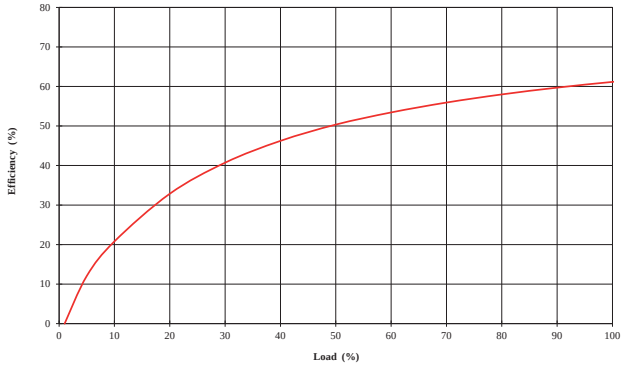


EFFICIENCY VS LOAD

3.3V Input

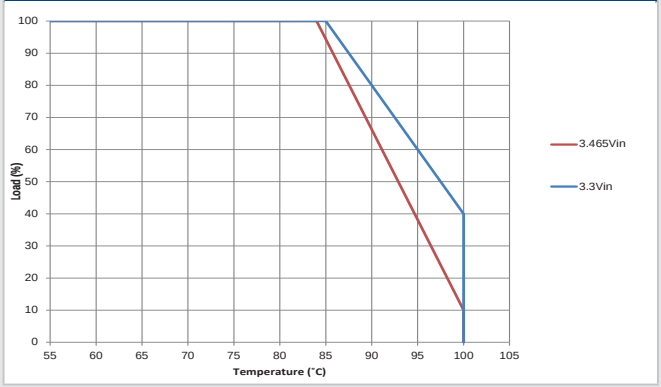


5V Input

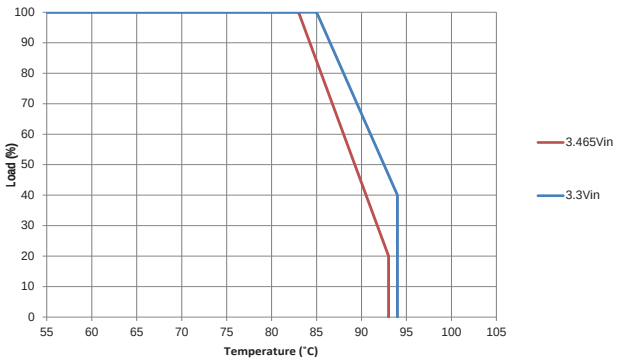


DERATING CURVES

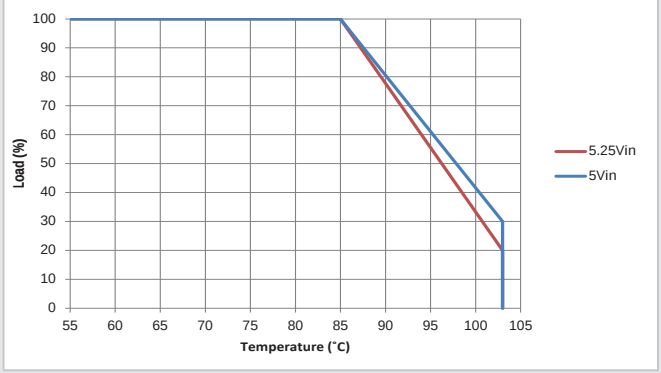
NXF1S0303MC



NXF1S0305MC



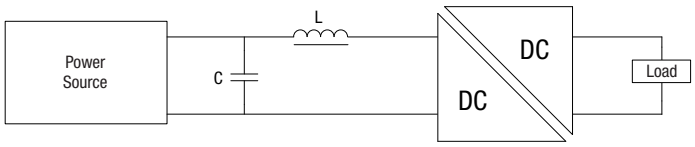
NXF1S0505MC



EMC FILTERING AND SPECTRA

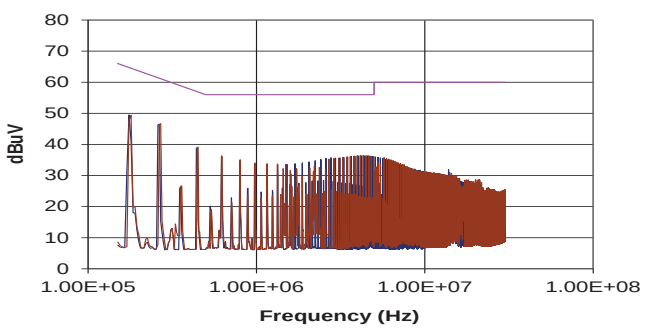
FILTERING

The following filter circuit and filter table shows the input filters typically required to meet conducted emissions limits for EN 55022 curve B using Quasi-Peak (pink line) and average (green line) detectors according to CISPR 22. The following plots show measurements of the positive (L1) and negative (L2) inputs for both Quasi-peak limit B adherence and Average limit B adherence.

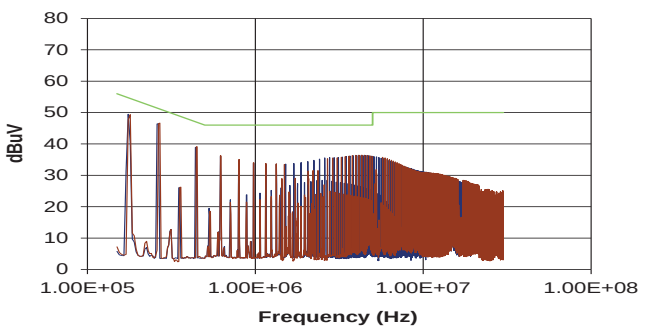


	Inductor			Capacitor	
	L, µH	SMD	Through Hole	C, µF	SMD
NXF1S0303MC	15	84103C	11R103C	10	GRM21BD70J226ME44
NXF1S0305MC	15	84103C	11R103C	10	GRM21BD70J226ME44
NXF1S0505MC	4.7	82472C	11R472C	3.3	GRM21BR71A475KA73

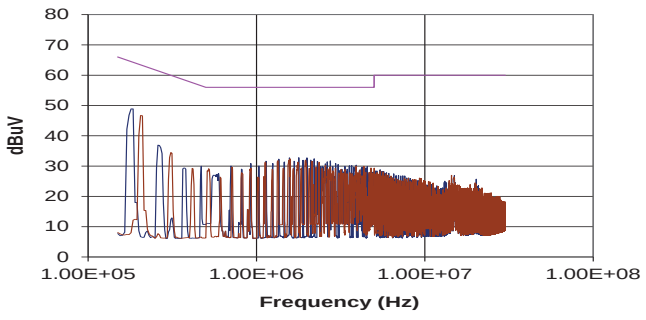
NXF1S0303MC (Quasi-Peak)



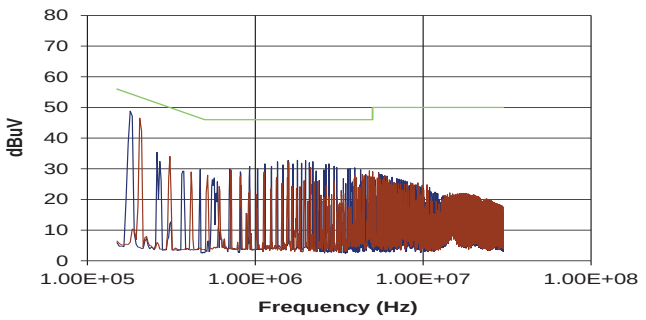
NXF1S0303MC (Average)



NXF1S0305MC (Quasi-Peak)

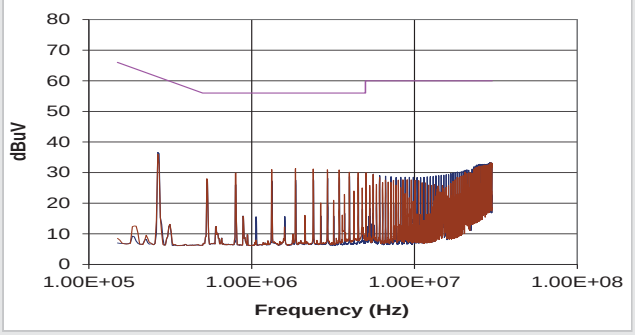


NXF1S0305MC (Average)

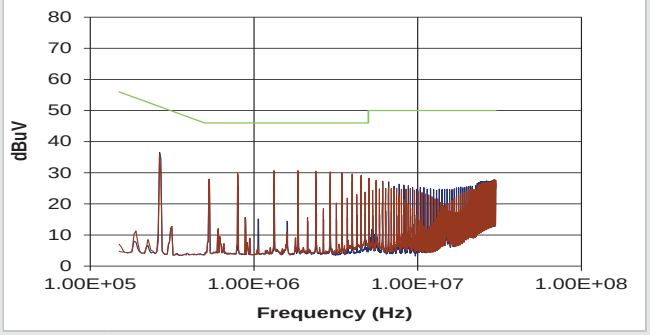


EMC FILTERING AND SPECTRA (Continued)

NXF1S0505MC (Quasi-Peak)

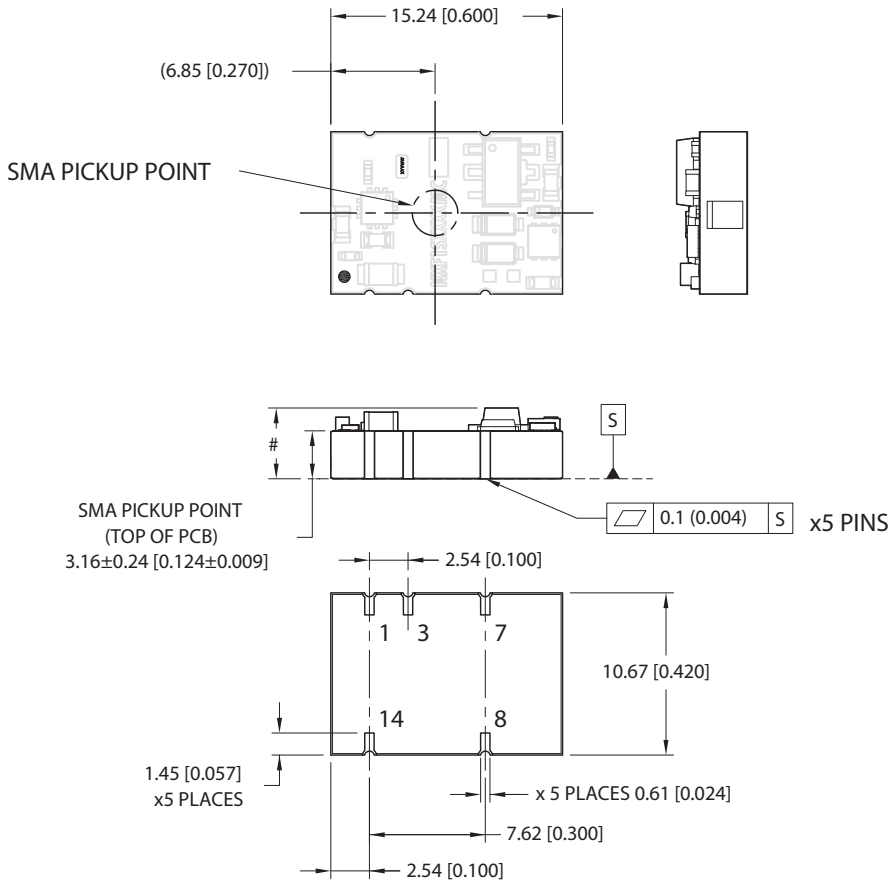


NXF1S0505MC (Average)



PACKAGE SPECIFICATIONS

Mechanical Dimensions



All dimensions in mm (inches), controlling dimension is mm. Tolerances (unless otherwise stated) ±0.20 (0.008).
Components shown for reference only

Weight: 1.3g

Pin Connections

NXF1S0505MC:

Pin	Function
1	-Vin
3	+Vin
7	-Vout
8	+Vout
14	NA

NA - Not available for electrical connection.

Pin Connections

All other variants:

Pin	Function
1	-Vin
3	+Vin
7	-Vout
8	+Vout
14	NC

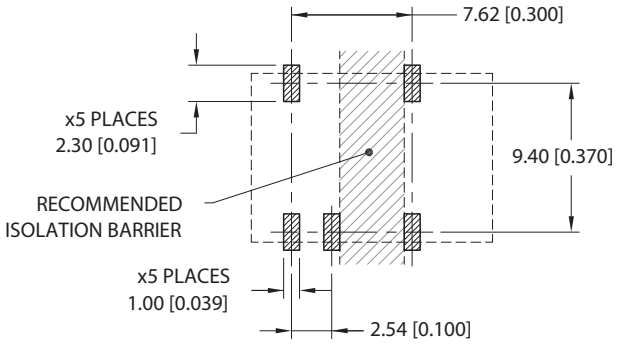
NC - No connection

Dimension Information

Variant	Dim #
NXF1S0303MC 4.41±0.4mm	4.41±0.4mm [0.174±0.016]
NXF1S0305MC	4.66±0.35mm
NXF1S0505MC	[0.183±0.014]

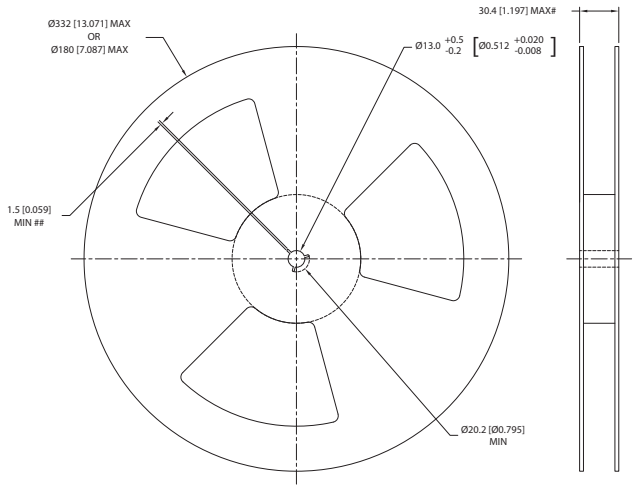
All dimensions in mm (inches), Controlling dimension is mm. Tolerances (unless otherwise stated) ±0.20 (0.008).

Recommended Footprint Details



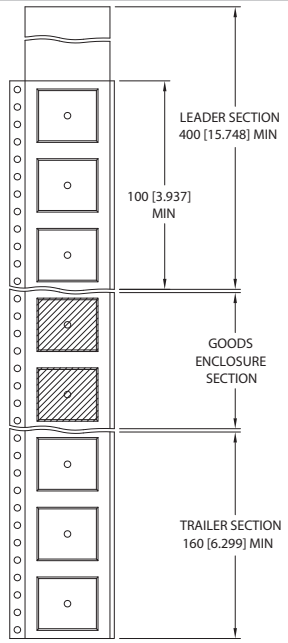
TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS



Tape & Reel specifications shall conform with current EIA-481 standard
Unless otherwise stated all dimensions in mm (inches)
Controlling dimension is mm
Measured at hub
Six equi-spaced slots on 180mm/7" reel

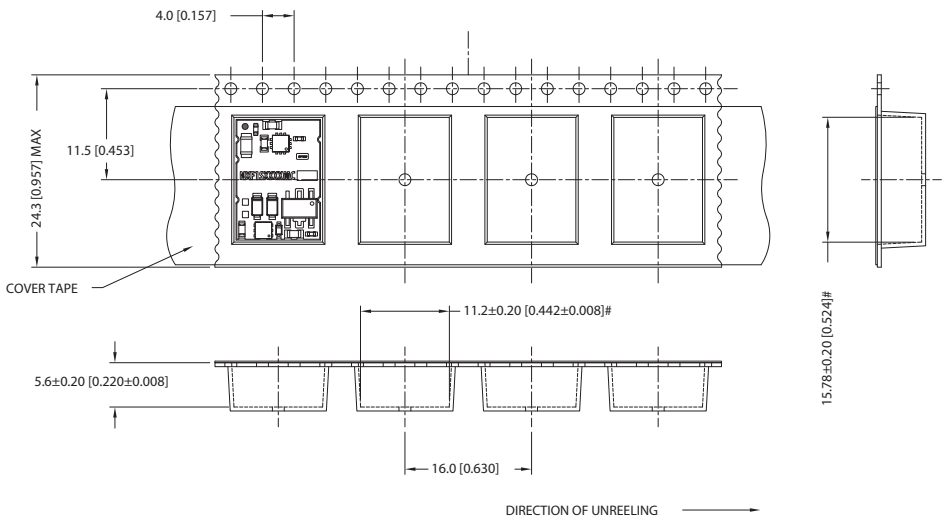
REEL PACKAGING DETAILS



Carrier tape pockets shown are illustrative only - Refer to carrier tape diagram for actual pocket details.

Reel Quantity: 7" - 160 or 13" -740

TAPE OUTLINE DIMENSIONS



Tape & Reel specifications shall conform with current EIA-481 standard
Unless otherwise stated all dimensions in mm (inches) ±0.1mm (±0.004 Inches)
Controlling dimension is mm
Components shall be orientated within the carrier tape as indicated
Measured on a plane 0.3mm above the bottom pocket

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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