

FEATURES

- Reinforced insulation to UL60950 recognised
- ANSI/AAMI ES60601-1, 2 MOOP & 1 MOPP recognised
- Output regulation <1%
- Single isolated output
- 3kVDC isolation 'Hi-Pot Test'
- 3.3V & 5V input
- 3.3V & 5V output
- 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 | TEL |
| NXF1S0303MC³ | 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 | 62 | 65 | 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 | | |

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 | |

ABSOLUTE MAXIMUM RATINGS

| | |
|---|------------------------------|
| Short-circuit protection | Continuous and auto recovery |
| Input voltage V _{IN} , NXF1S03 types | 4V |
| Input voltage V _{IN} , NXF1S05 types | 7V |

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 |

GENERAL CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---------------------|-------------|------|------|------|-------|
| Switching frequency | NXF1S0303MC | | 90 | | kHz |
| | NXF1S0305MC | | 106 | | |
| | NXF1S0505MC | | 270 | | |

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 | | | | | |

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.

3. NXF1S0303MC is in preliminary stages.

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



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 pending recognition 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 recognized 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.

UL60950

The NXF1 series is recognised by Underwriters Laboratory (UL) to UL60950 for reinforced insulation to a working voltage of 125Vrms and for basic insulation to a working voltage of 250Vrms.

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.

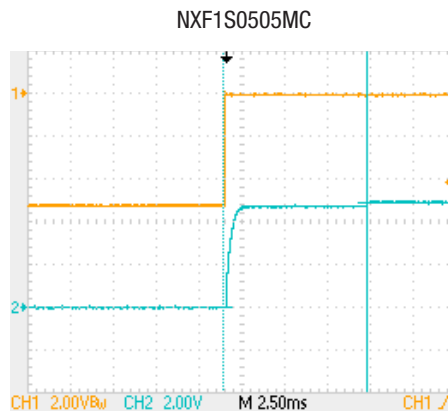
APPLICATION NOTES (continued)

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 |
|--------------------|----------------------------|
| 3.3 | 33 |
| 5 | 47 |

| | Start-up time |
|-------------|---------------|
| | ms |
| NXF1S0303MC | 0.35 |
| NXF1S0305MC | 0.24 |
| NXF1S0505MC | 15 |



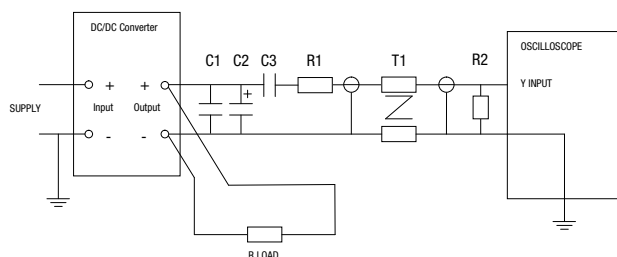
Ripple & Noise Characterisation Method

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

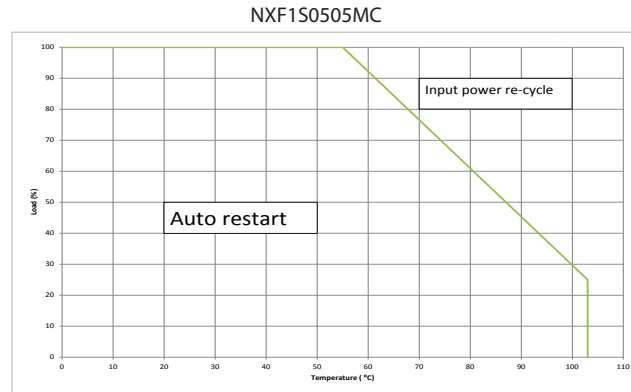


APPLICATION NOTES

Short Circuit Performance

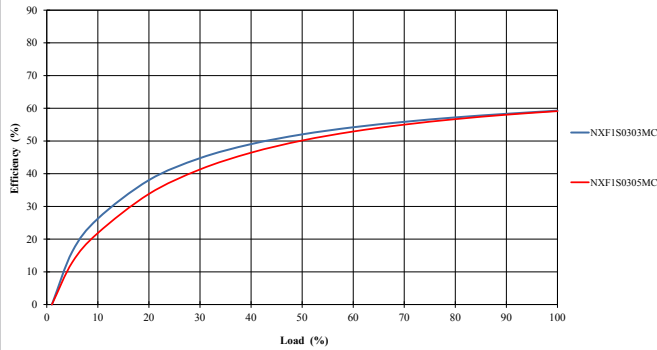
The NXF1 series short circuit protection is continuous, the NXF1S0303MC and NXF1S0305MC will auto restart under all datasheet operating conditions after a short circuit.

For the NXF1S0505MC, the short circuit protection is continuous, however, at higher temperatures or output current, the part will not automatically restart following a short circuit condition. At higher temperatures or higher load as shown in the below graph, the input power must be re-cycled for the part to restart.

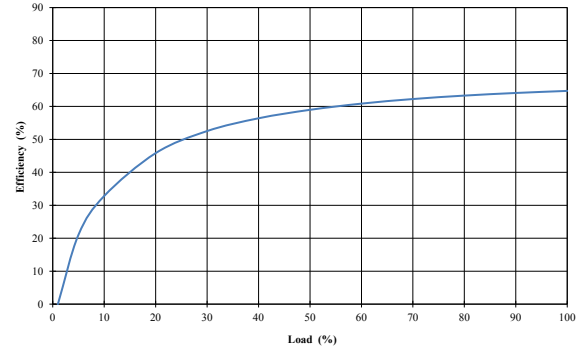


EFFICIENCY VS LOAD

3.3V Input

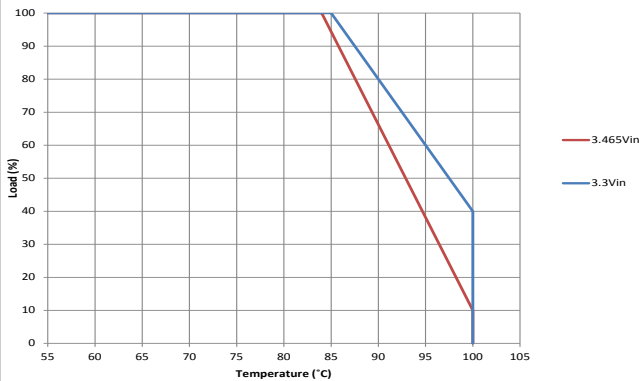


5V Input

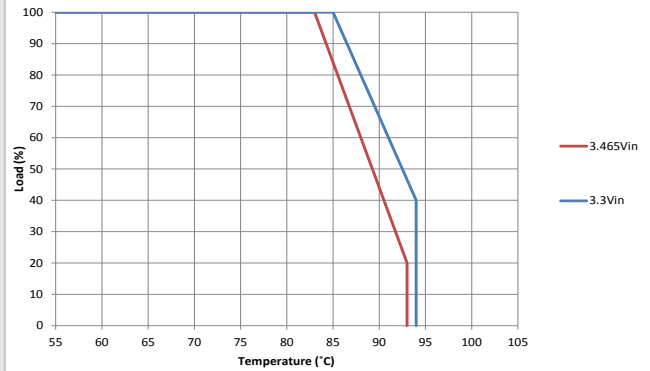


DERATING CURVES

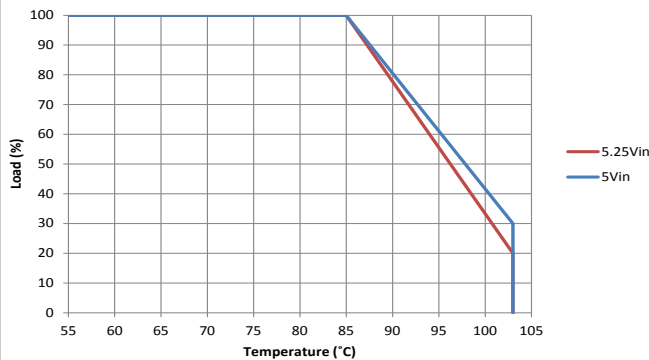
NXF1S0303MC



NXF1S0305MC



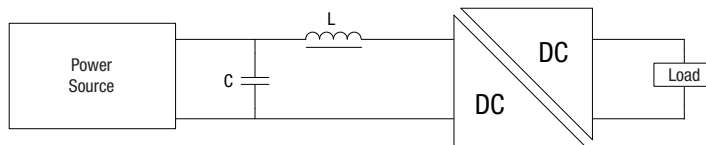
NXF1S0505MC



EMC FILTERING AND SPECTRA

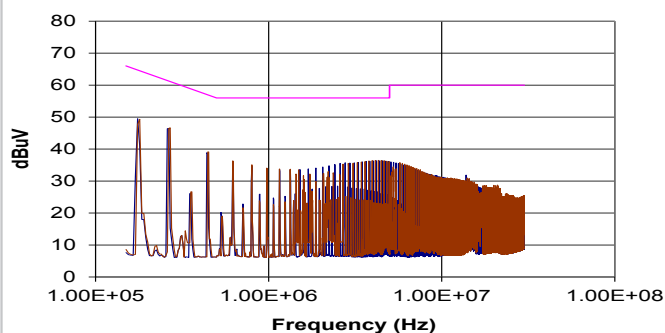
FILTERING

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.

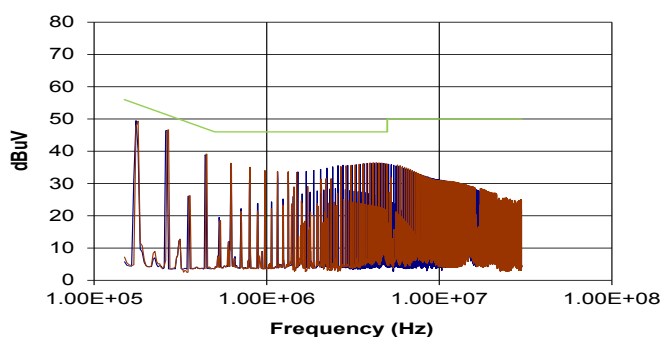


| | Inductor | | | Capacitor | |
|-------------|------------|--------|--------------|------------|-------------------|
| | L, μ H | SMD | Through Hole | C, μ F | SMD |
| NXF1S0303MC | 15 | 84103C | 11R103C | 10 | GRM21BD70J226ME44 |
| NXF1S0305MC | 15 | 84103C | 11R103C | 10 | GRM21BD70J226ME44 |
| NXF1S0505MC | 3.3 | 82472C | 11R472C | 4.7 | GRM21BR71A475KA73 |

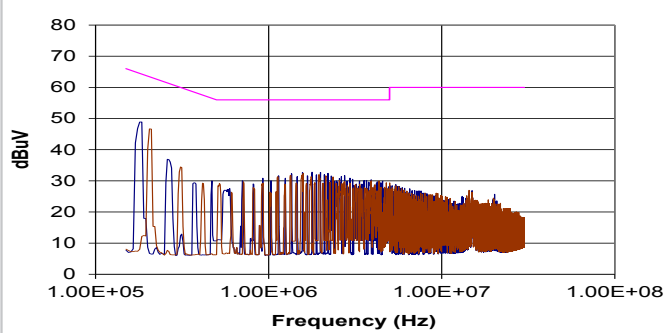
NXF1S0303MC (Quasi-Peak)



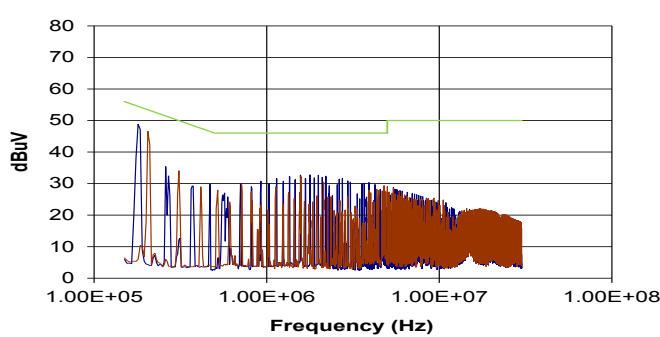
NXF1S0303MC (Average)



NXF1S0305MC (Quasi-Peak)

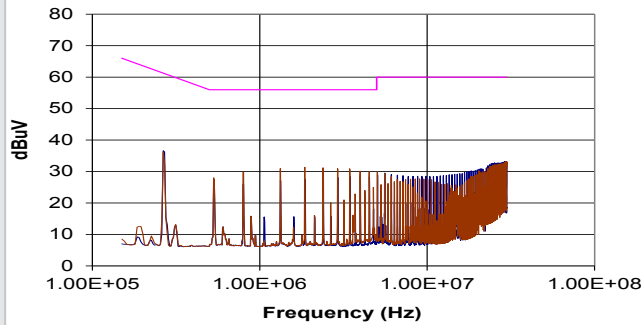


NXF1S0305MC (Average)

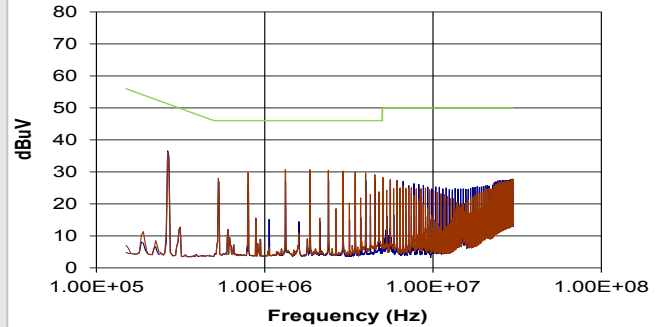


EMC FILTERING AND SPECTRA (continued)

NXF1S0505MC (Quasi-Peak)

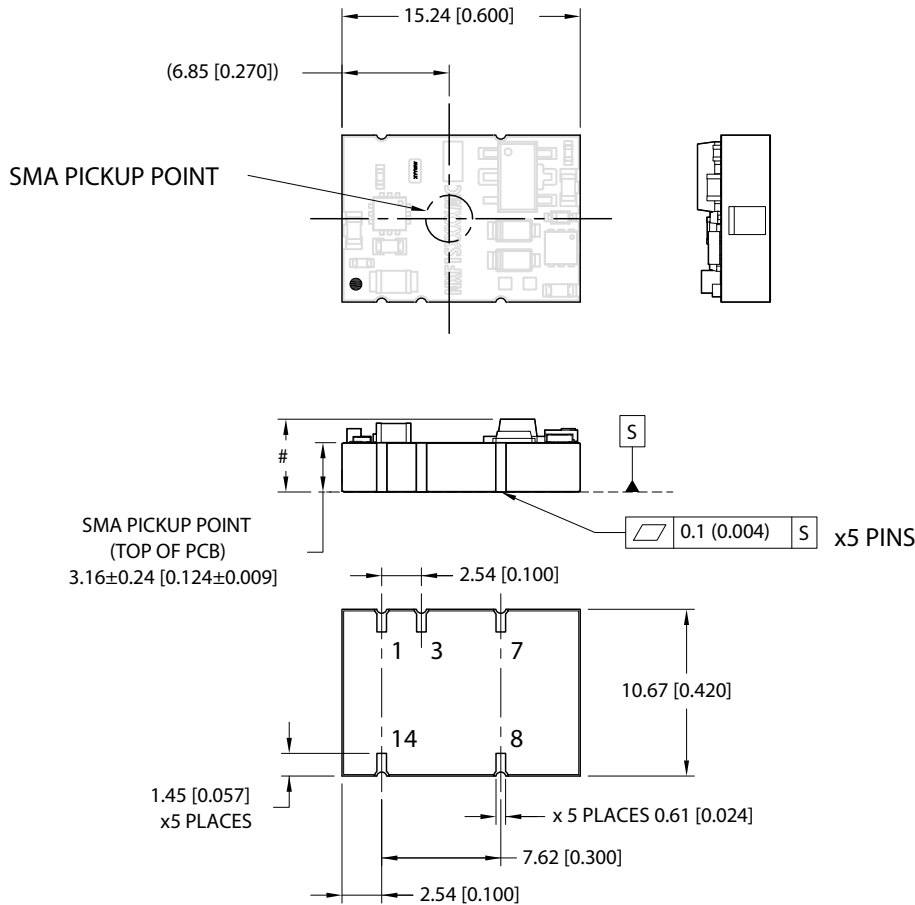


NXF1S0505MC (Average)



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 |

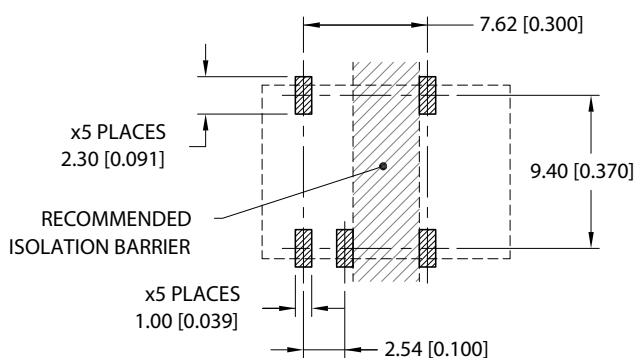
NC - No connection

Dimension Information

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

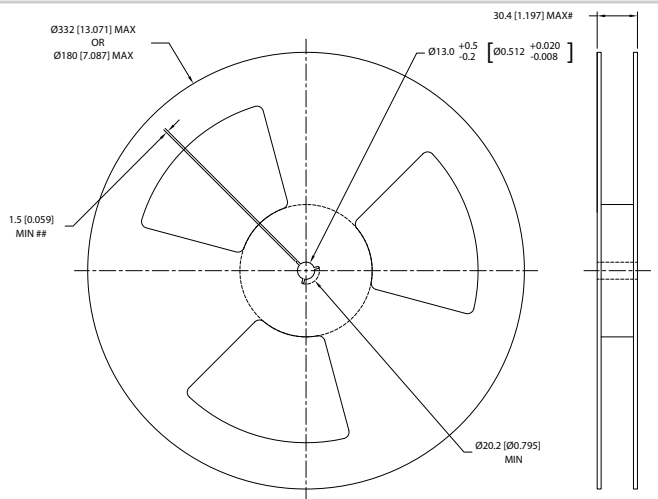
All dimensions in mm (inches). Controlling dimension is mm. Tolerances (unless otherwise stated) ±0.20 (0.008).

Recommended Footprint Details



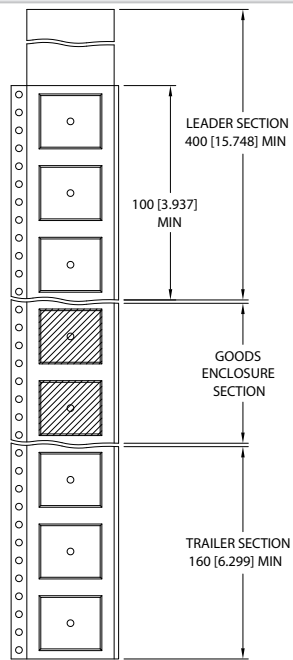
TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS



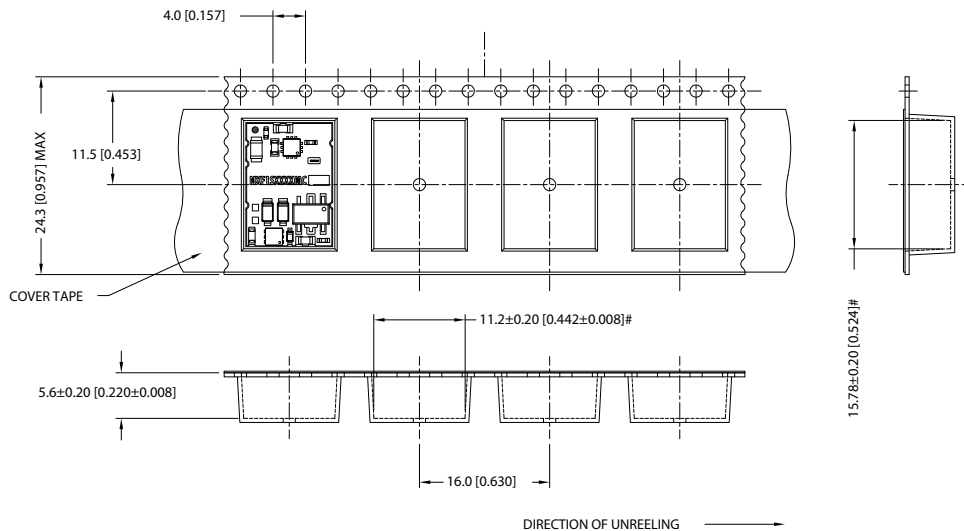
TAPE & REEL SPECIFICATIONS SHALL CONFORM WITH CURRENT EIA-481 STANDARD UNLESS OTHERWISE STATED ALL DIMENSIONS IN mm (INCHES) CONTROLLING DIMENSION IS mm
 # MEASURED AT HUB
 ## SIX EQUI-SPACED SLOTS ON 180mm/7" REEL

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



**This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:
 Refer to: <http://www.murata-ps.com/requirements/>**

Murata Power Solutions, Inc. 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 descriptions contained herein do not imply the granting of licenses to make, use, or sell equipment constructed in accordance therewith. Specifications are subject to change without notice. © 2019 Murata Power Solutions, Inc.