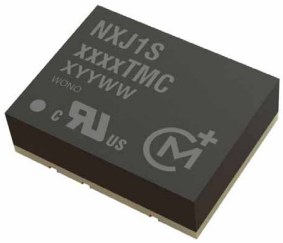
NXJ1T Series

Isolated 1W Single Output SM DC-DC Converters



FEATURES

- Patent protected
- Lower profile
- UL62368-1 recognised
- ANSI/AAMI ES60601-1, 1 MOPP pending recognition
- 4.2kVDC isolation “Hi Pot Test”
- Automated manufacture
- Industry standard footprint
- Short circuit protection
- Under voltage lockout
- Manufactured in the UK
- Characterised CMTI >200kV/µS
- Continuous barrier withstand voltage 400Vrms

PRODUCT OVERVIEW

The NXJ1T series is a new patented technology, industry standard footprint DC-DC converter. Manufactured in the UK incorporating proprietary block-coil transformer technology in a surface mount moulded package.

The NXJ1T provides high isolation, low leakage current, and exceptional temperature cycling performance in harsh industrial environments.

SELECTION GUIDE

Order Code[1]	Nominal Input Voltage	Output Voltage	Rated Input Current	Output Current	Load Regulation (Typ)	Load Regulation (Max)	Output Ripple & Noise (Typ)	Output Ripple & Noise (Max)	Efficiency (Min)	Efficiency (Typ)	Switching Frequency (Typ)	Isolation Capacitance	MTTF[2]	
													MIL.	Tel.
	V	V	mA	mA	%	%	mVp-p		%	%	MHz	pF	kHrs	
NXJ1S0505TMC	5	5	250	200	24	35	5	20	71	76	1.5	2.5	5264	38962
NXJ1S0505T6MC	5	5	250	200	24	35	5	20	71	76	1.5	2.5	5264	38962
NXJ1S0505PTMC	5	5	250	200	24	35	5	20	71	76	1.5	2.5	4104	34632
NXJ1S0505PT6MC	5	5	250	200	24	35	5	20	71	76	1.5	2.5	4104	34632

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 5V input type	4.5	5.0	5.5	V
UVLO		3.3		3.9	V
Input reflected ripple current	5V input		10		mA p-p

ISOLATION CHARACTERISTICS

Parameter		Conditions		Min.	Typ.	Max.	Units
Isolation voltage		Production tested for 1 second		4200			VDC
		Qualification tested for 1 minute		4200			
Continuous barrier withstand voltage		Non-safety barrier application				400	Vrms
Safety standard	UL62368-1	Reinforced	Creepage and clearance 4mm			200	Vrms
		Basic				250	
	ANSI/AAMI ES60601-1[3]	1 MOPP				250	

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated power	T_A=-40°C to 105°C			1.0	W
Voltage set point accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN}		0.01	0.05	%/%

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	see derating curves	-40		125	°C
Storage		-40		125	
Product temperature rise above ambient	1 Layer PCB		20		
	4 Layer PCB		10		
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS

Input voltage $5V_{IN}$		7V
Short Circuit protection[4]	NXJ1SXXXXPT(6)MC	Continuous
	NXJ1SXXXXT(6)MC	Momentary (5 seconds)

1. Components are supplied in tape and reel packaging, please refer to package specification section. Orderable part numbers are NXJ1SXXXXTMC-R7 (230 pieces per reel), or NXJ1SXXXXMC-R13 (930 pieces per reel).
2. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
3. ANSI/AAMI ES60601-1 recognition is currently pending.
4. Momentary short circuit protection tested up to 100°C.

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

RoHS COMPLIANT

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

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 NXJ1T series of DC-DC converters are all 100% production tested at 4.2kVDC for 1 second and have been qualification tested at 4.2kVDC for 1 minute.

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

The NXJ1T series has been recognised by Underwriters Laboratory to 200Vrms Reinforced Insulation and 250Vrms Basic insulation, please see safety approval section for more information. When the insulation in the NXJ1T series is not used as a safety barrier, i.e. provides functional isolation only, continuous or switched voltages across the barrier up to 400Vrms are sustainable.

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 NXJ1T series has a proprietary block-coil transformer, While parts can be expected to withstand several times the stated test voltage, Any material 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 NXJ1T series is pending recognition by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 1 MOPP (Means Of Patient Protection) based upon a working voltage of 250 Vrms max, between input and output.

UL62368-1

The NXJ1T series has been recognised by Underwriters Laboratory (UL) to UL62368-1 for reinforced insulation to a working voltage of 200Vrms and for basic insulation to a working voltage of 250Vrms[1].

Creepage and clearance is 4mm.

FUSING

The NXJ1T 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, 5V: T0.5A

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

RoHS COMPLIANCE AND MSL INFORMATION

RoHS COMPLIANT

This series is compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems.

The NXJ1T series can be soldered in accordance with J-STD-020 and have a classification temperature of 245°C and moisture sensitivity level 2a. 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

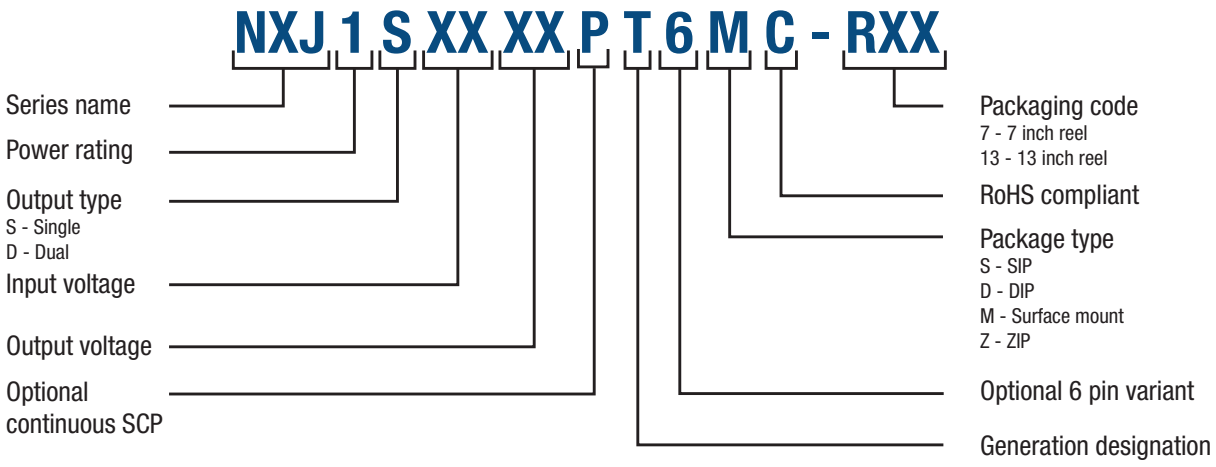
1. Basic insulation pending working voltage upgrade to 400Vrms

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 +125°C. 2 full cycles per hour.
Humidity bias	JEDEC JESD22-A101	1000 hours at 85°C ±2°C, 85 ± 5% RH with continuous bias
HAST (Unbiased)	JEDEC JESD22-A118	96 hours at 130°C ±2°C, 85% ± 5% R.H.
High temperature operating life (HTOL)	JEDEC JESD22-A108	1000 hours at 105 ±5°C.
High temperature Storage life	JEDEC JESD22-A103	1000 hours at 125°C (-0/+10)°C.
Low temperature Storage life	JEDEC JESD22-A119	1000 hours at -40°C (-10/+5)°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 60ºC/60%RH.
Solderability	Based on IPC/ECA J-STD-002, Test B and B1	SnPb (Test B) For leaded solderability the parts are baked in an oven for 4 hours ±15 min. at a temperature of 155±5°C. Dipped in solder at 255°C ±5°C for 5 +0/-0.5 seconds. 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.
Shock	JEDEC JESD22-B110	1500g (± 10%), 5 x 0.5ms (+/-15%) half sine pulses in each of 6 planes (± X, ± Y, ± Z) 30 pulses in total.
Vibration	JEDEC JESD22-B103	20Hz to 2 kHz to 20Hz (logarithmic variation) in >4 minutes, 4 times in each orientation (i.e. 12times), 20G (±10%) peak acceleration.
Aqueous wash	Internal reference standard	Aqueous / ultrasonic process in a suitable chemical for 30 minutes at a controlled temperature, using a water wash at low pressure with demineralised water wash at low pressure and Drying in a vacuum oven.
Resistance to cleaning agents	Internal reference standard	Step 1: Solvent washed – Novec 71IPA & Topklean EL-20A. Pulsed ultrasonic immersion Step 2: Parts rubbed with a cloth soaked with water for 15 seconds. Repeated 3 times Step 3: Tape applied across the parts printed side and then removed. Repeated 3 times Step 4: Parts rubbed with a cloth soaked with petroleum spirit for 15 seconds. Repeated 3 times.
Board flex	AEC-Q200-005	A 2mm (minimum) deflection is applied once for 60 (+5) seconds.
Terminal strength/Shear stress test/Push test	AEC-Q200-006	17.7N force is applied to parts mounted on a PCB once for 60 (+1) seconds. Applied to separate samples in x and y axes.
ESD	ANSI/ESDA/JEDEC JS-001	HBM Testing Standard at 5 stress levels; 0.5kV, 1kV, 2kV and 4kV.
	ANSI/ESDA/JEDEC JS-002	CDM Testing Standard at 5 stress levels; 125V, 250V, 500V, 750V, 1000V.

PART NUMBER STRUCTURE



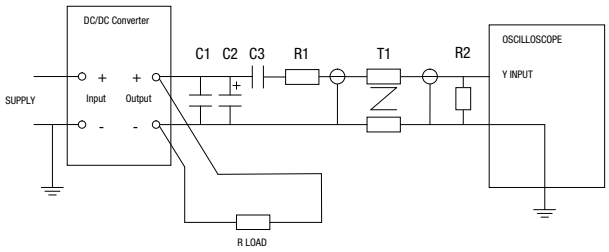
CHARACTERISATION TEST METHODS

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

Minimum Load

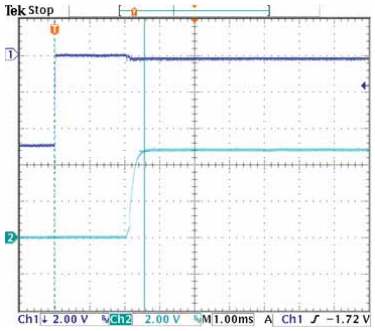
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

Capacitive Loading & Start Up

Typical start up times for this series, with a typical input voltage rise time of 3ms with resistive only load, and with added output capacitance of 10µF, are shown in the table below. The product series will start into capacitance up to 3300µF with increased start times

Part Number	Start-up time (mS)
NXJ1S0505(P)T(6)MC	3

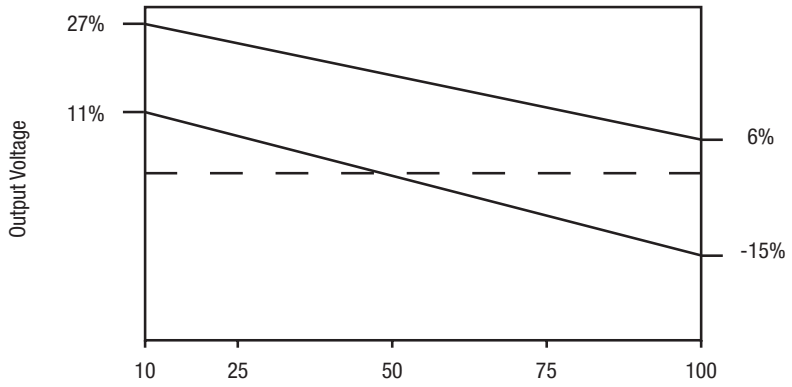
Typical Start-Up Wave Form



TOLERANCE ENVELOPES

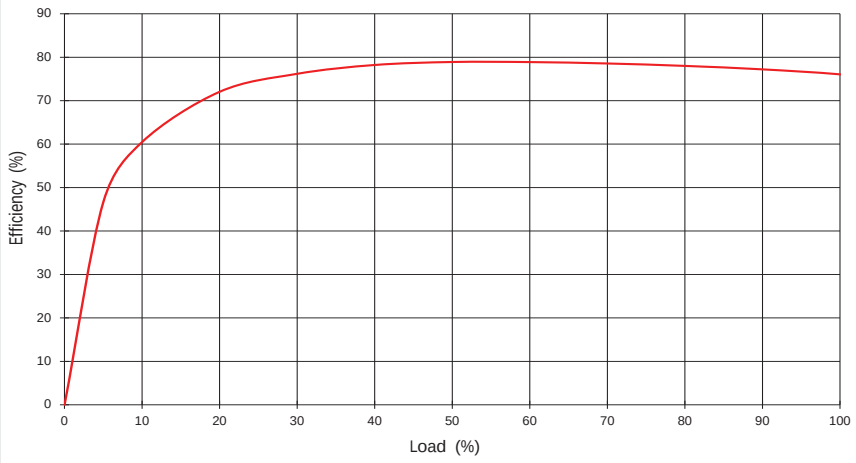
The voltage tolerance envelope shows typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to changes in output loading.

5V Input



EFFICIENCY VS LOAD

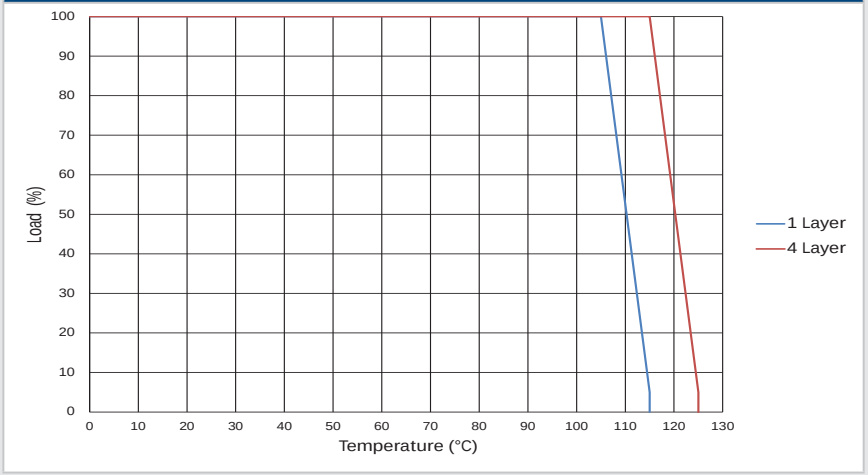
5V Input



TEMPERATURE DERATING

The NXJ1T series has been designed to minimise the thermal impedance when mounted onto a customers application PCB by using multiple surface mount pads for each connection. All thermal measurements were carried out in still air using a test PCB designed in accordance with standard JESD51-9 (Test Boards for Area Array Surface Mount Package Thermal Measurements). A single layer and a 4 layer have been used and this demonstrates that a higher operating temperature can be achieved when the customers application PCB is designed to incorporate multiple layers and large copper planes. Minimum 5% output load is required when operating at ambient temperatures of 125°C. Please contact Murata for further information.

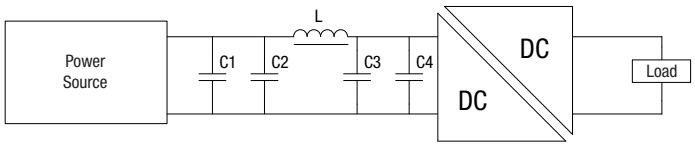
5V Input



EMC FILTERING AND SPECTRA

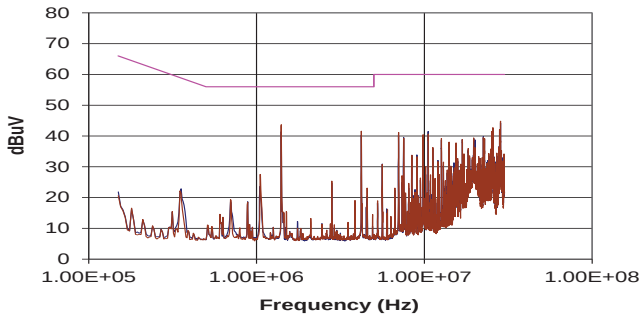
FILTERING

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.

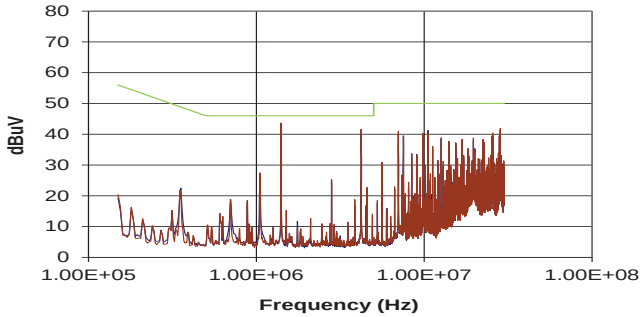


	Inductor			Capacitor		
	L, µH	SMD	Through Hole	C1, µF	C2 & C4, pF	C3, µF
NXJ1S0505(P)T(6)MC	10	84103C	11R103C	47	22	10

NXJ1S0505(P)T(6)MC (Quasi-Peak)

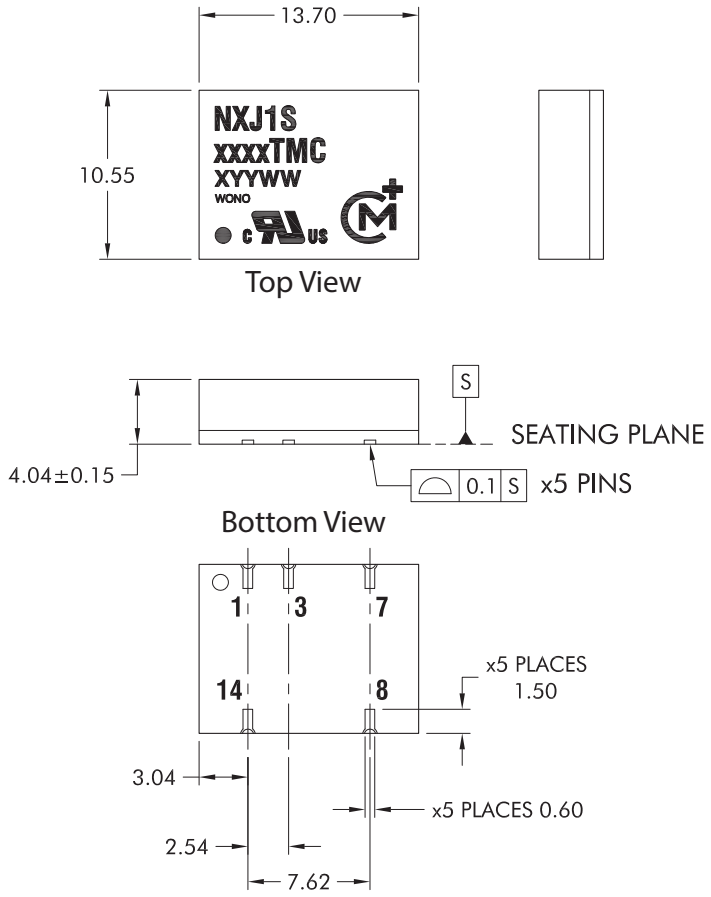


NXJ1S0505(P)T(6)MC (Average)



PACKAGE SPECIFICATIONS

Mechanical Dimensions - 5 Pin Variant



All dimensions in mm. Tolerances (unless otherwise stated) ±0.1.

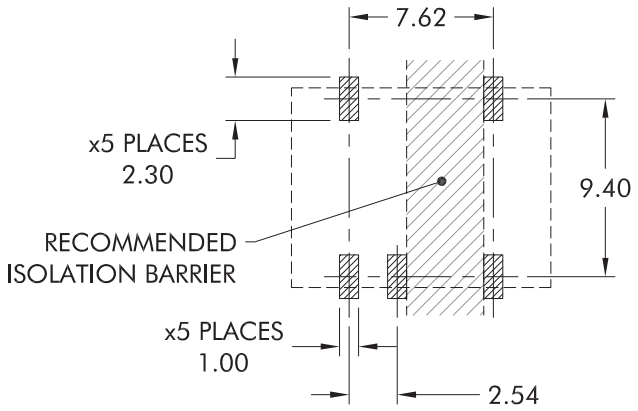
Weight: 1.5g

Pin Connections

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

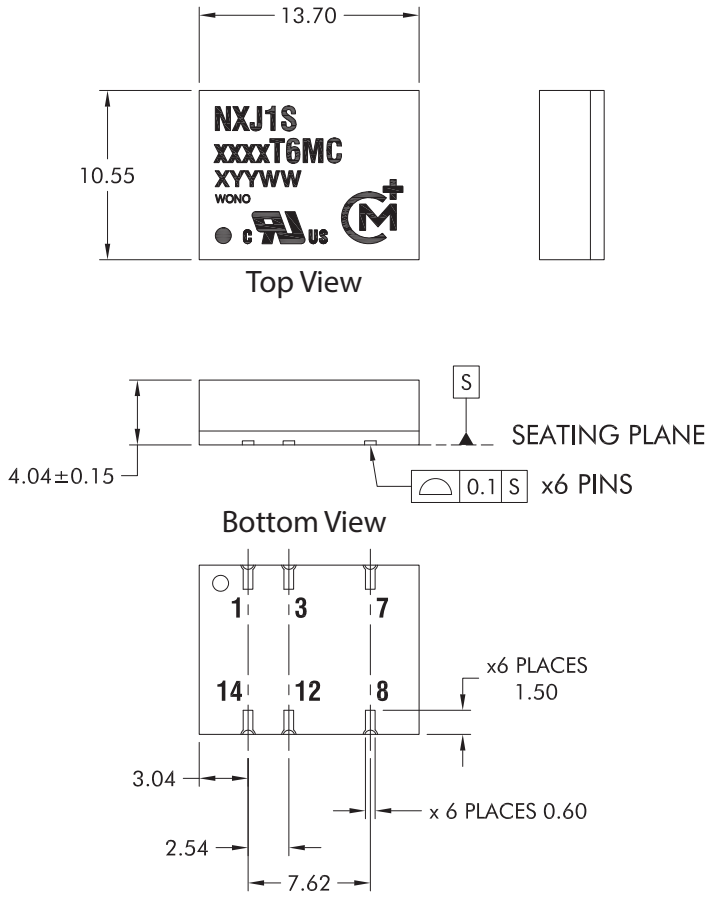
NC - No connection.

Recommended Footprint Details



PACKAGE SPECIFICATIONS

Mechanical Dimensions - 6 Pin Variant



All dimensions in mm. Tolerances (unless otherwise stated) ±0.1.

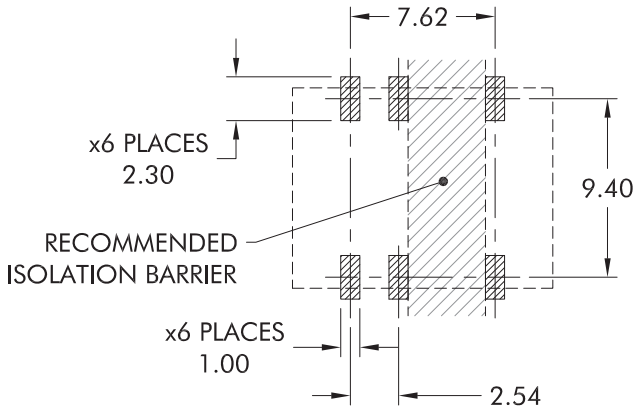
Weight: 1.5g

Pin Connections

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

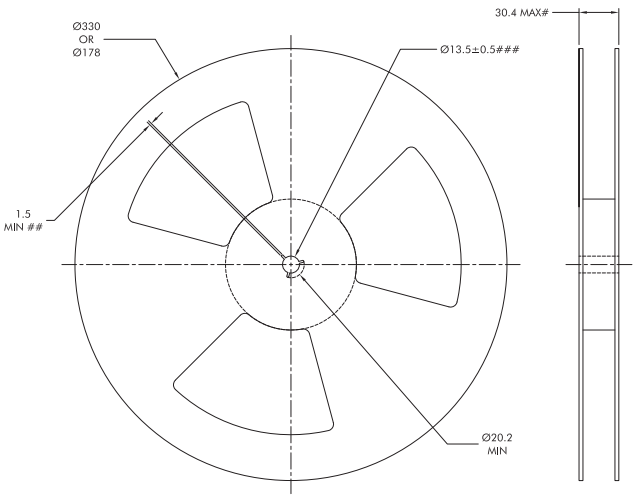
NC - No connection.

Recommended Footprint Details



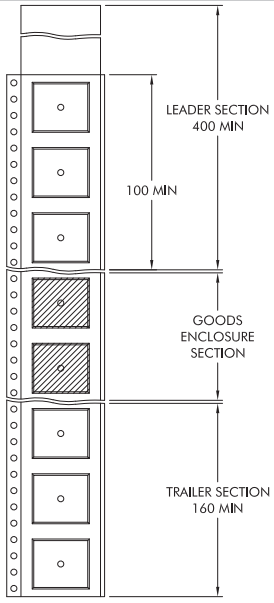
TAPE & REEL SPECIFICATIONS

REEL OUTLINE DIMENSIONS



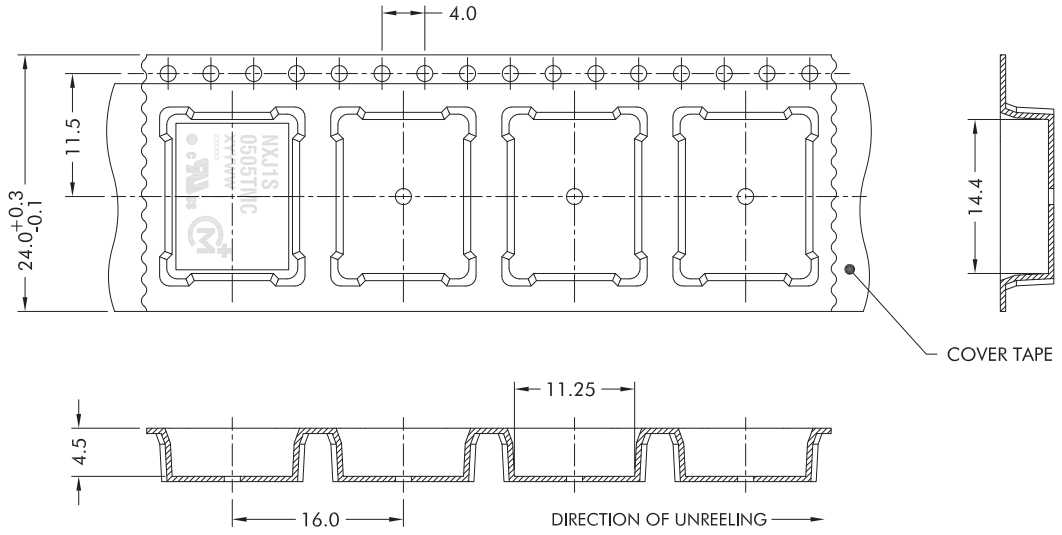
All dimensions in mm.
Measured at hub
Six equi-spaced slots on 178mm reel
13.5±0.3mm on 178mm reel

REEL PACKAGING DETAILS



Reel Quantity: 7" - 230 or 13" - 930
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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