



### FEATURES

- Patents protected
- DC link voltage 1kVDC
- UL62368-1 recognised<sup>3</sup>
- ANSI/AAMI ES60601-1, 2 MOOP, 1MOPP recognised<sup>4</sup>
- 5.2kVDC Isolation 'Hi Pot Test'
- Substrate embedded transformer
- Automated manufacture
- Halogen free
- Operation to 95°C with derating
- Ultra low isolation capacitance 2pF

### PRODUCT OVERVIEW

The NXJ2 series is a new range of lower profile, fully automated manufacture surface mount DC-DC converters. The NXJ2 series automated manufacturing process with substrate embedded transformer, offers increased product reliability and repeatability of performance in a halogen free, iLGA inspectable package. The NXJ2 series, industry standard footprint is compatible with existing designs.

The NXJ2 series has a MSL rating 2, and is compatible with a peak reflow solder temperature of 260°C as per J-STD-020.

### SELECTION GUIDE

Order Code <sup>1</sup>	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 <sup>2</sup>	
	V	V	mA	mA	%	%	mVp-p	mVp-p	%	%	kHz	pF	MIL 217	Telecordia
													kHrs	kHrs
<b>NXJ2S0505MC</b>	5	5	550	400	7.5	10	50	110	68.5	72.5	140	2	2874	40967
<b>NXJ2S1212MC</b>	12	12	215	167	7	9	30	70	72	75	120	2	1766	65080
<b>NXJ2S1215MC</b>	12	15	215	133	8	10	25	60	75	77.5	110	2.2	1334	49049
<b>NXJ2S2405MC</b>	24	5	110	400	8	10	70	170	73	76.5	100	2.4	2026	33111
<b>NXJ2S2415MC</b>	24	15	105	133	6.5	8	20	50	74.5	78.5	95	2.4	1232	44260

### INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 5V input types	4.5	5.0	5.5	V
	Continuous operation, 12V input types	10.8	12	13.2	
	Continuous operation, 24V input types	21.6	24	26.4	
Input reflected ripple current	5V input		15		mA p-p
	12V & 24V input		5		

### ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage	Production tested for 1 second	5200			VDC
	Qualification tested for 1 minute	5200			
Resistance	Viso= 1000VDC	10			GΩ
Safety standard	UL62368-1			250	Vrms
	ANSI/AAMI ES60601-1	2 MOOP, 1 MOPP		250	

### OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated power	T <sub>A</sub> =-40°C to 85°C			2.0	W
Voltage set point accuracy	See tolerance envelope				
Line regulation	High V <sub>IN</sub> to low V <sub>IN</sub>	24V input types	1	1.1	%/%
		All other input types	1.1	1.2	



**25**  
For full details go to  
[www.murata.com/en-global/products/power/rohs](http://www.murata.com/en-global/products/power/rohs)



1. Components are supplied in tape and reel packaging, please refer to package specification section. Orderable part numbers are NXJ2SXXXXMC-R7 (135 pieces per reel), or NXJ2SXXXXMC-R13 (600 pieces per reel).
2. Calculated using MIL-HDBK-217 FN2 and Telecordia SR-332 calculation model at T<sub>A</sub>=25°C with nominal input voltage at full load.
3. NXJ2S2405MC and NXJ2S2415MC do not hold UL62368-1 recognition.
4. NXJ2S2405MC and NXJ2S2415MC do not hold ANSI/AAMI ES60601-1 recognition.

All specifications typical at T<sub>A</sub>=25°C, nominal input voltage and rated output current unless otherwise specified.



### TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		125	
Product temperature rise above ambient	5V input types		35		
	12V input types		30		
	24V input types		25		
Cooling	Free air convection				

### ABSOLUTE MAXIMUM RATINGS

Input voltage $V_{IN}$ , NXJ2S05 types	7V
Input voltage $V_{IN}$ , NXJ2S12 types	15V
Input voltage $V_{IN}$ , NXJ2S24 types	28V

### 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 NXJ2 series of DC-DC converters are all 100% production tested at 5.2kVDC for 1 second and have been qualification tested at 5.2kVDC for 1 minute.

The NXJ2 series is recognised by Underwriters Laboratory, please see safety approval section for more information. When the insulation in the NXJ2 series is not used as a safety barrier, i.e. provides functional isolation only, continuous or switched voltages across the barrier up to 1kV are sustainable. This is established by measuring the partial discharge inception voltage in accordance with IEC 60270. Please contact Murata for further information.

#### 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 NXJ2 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 NXJ2 series is recognised by Underwriters Laboratory (UL) to ANSI/AAMI ES60601-1 and provides 1 MOPP (Means Of Patient Protection) and 2 MOOP (Means Of Operator Protection) based upon a working voltage of 250 Vrms max, between input and output. The NXJ2S2405MC and NXJ2S2415MC do not hold ANSI/AAMI ES60601-1 recognition.

#### UL62368-1

The NXJ2 series is recognised by Underwriters Laboratory (UL) to UL62368-1 for reinforced insulation to a working voltage of 250Vrms. The NXJ2S2405MC and NXJ2S2415MC do not hold UL62368-1 recognition.

Creepage and clearance 5mm.

Working altitude 5000m

Over voltage category (OVC) II

#### FUSING

The NXJ2 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: 1A

Input Voltage, 12V: 500mA

Input Voltage, 24V: 250mA

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

### RoHS COMPLIANCE AND MSL INFORMATION



This series is compatible with Pb-Free soldering systems and is also backward compatible with Sn/Pb soldering systems. The NXJ2 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.

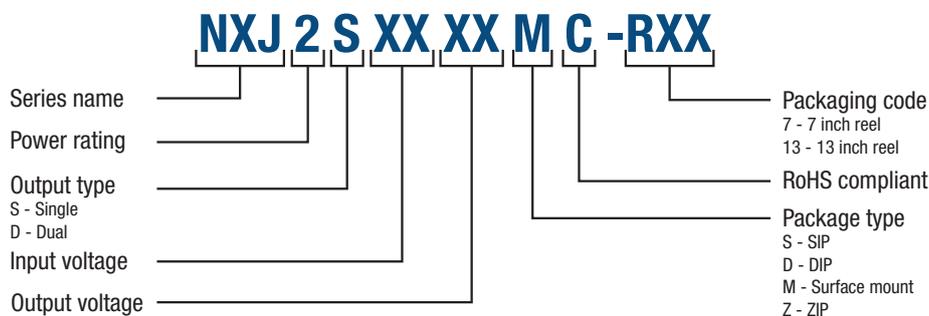
For further information, please visit [www.murata.com/en-global/products/power/rohs](http://www.murata.com/en-global/products/power/rohs)

**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 (5V and 12V input types)	JEDEC JESD22-A104	1000 cycles between two temperature extremes set to achieve -40°C and +105°C. 2 full cycles per hour.
Temperature cycling (24V input types)	JEDEC JESD22-A104	500 cycles between two temperature extremes set to achieve -40°C and +105°C. 2 full cycles per hour.
HAST	JEDEC JESD22-A110	96 Hrs at 130°C ±2°C, 85% ±5% R.H. H
Storage life	JEDEC JESD22-A103, Condition A	>125°C for 1008 hours, read point at end point 1008 hours.
MSL	IPC/JEDEC J-STD-020	Bake samples in 125 (+5/-0°C) for 24 hours minimum before conditioning in the Temperature/Humidity chamber. 168 hours 85°C/60%RH and Pb Free JEDEC Max profile conditioning with electrical testing, co-planarity (<100µm) and >8X microscope inspection before and after.
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: 5.72m/s <sup>2</sup> rms; Traverse: 5.72/s <sup>2</sup> rms; Longitudinal: 5.72m/s <sup>2</sup> 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 <sup>2</sup> . Device is secured by pads.
Solderability	IPC/ECA J-STD-002. Test A1	Pb-free (Test A1) For lead free solderability the parts are conditioned in a steam ager for 8 hours ±15 min. at a temperature of 93°C ±3°C. Dipped in solder at 245°C ±5°C for 5 (+0/-0.5) seconds.
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**



**CHARACTERISATION TEST METHODS**

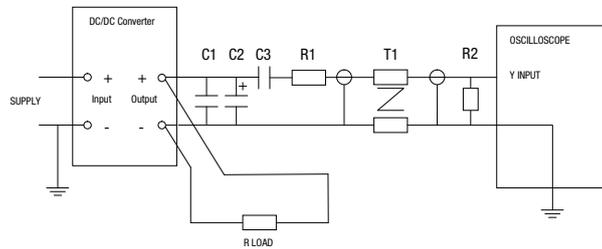
**Ripple & Noise Characterisation Method**

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

C1	1 $\mu$ F X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC-DC converter
C2	10 $\mu$ F 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 100m $\Omega$ at 100 kHz
C3	100nF multilayer ceramic capacitor, general purpose
R1	450 $\Omega$ resistor, carbon film, $\pm$ 1% tolerance
R2	50 $\Omega$ 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**

**Gate Drive Applications Advisory Note**

For general guidance for product usage in gate drive applications please refer to [“gate drive application notes”](#).

**Advisory Notes**

The NXJ2 series is not hermetically sealed, customers should ensure that parts are fully dried before input power application.

**Minimum Load**

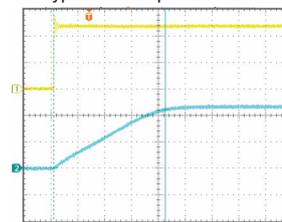
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

**Capacitive Loading & Start Up**

Typical start up times for this series, with a typical input voltage rise time of 2.2µs with resistive only load, and with added output capacitance of 10µF, are shown in the table below.

Part Number	Start-Up Time	
	µS	
NXJ2S0505MC	260	
NXJ2S1212MC	840	
NXJ2S1215MC	1200	
NXJ2S2405MC	160	
NXJ2S2415MC	1110	

Typical Start-Up Wave Form



**Output Ripple Reduction**

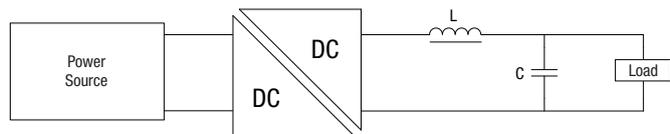
By using the values of inductance and capacitance stated, the output ripple at the rated load is lowered to 5mV p-p max.

**Component selection**

**Capacitor:** It is required that the ESR (Equivalent Series Resistance) should be as low as possible, ceramic types are recommended. The voltage rating should be at least twice (except for 15V output), the rated output voltage of the DC-DC converter.

**Inductor:** The rated current of the inductor should not be less than that of the output of the DC-DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC-DC converter. The SRF (Self Resonant Frequency) should be >20MHz.

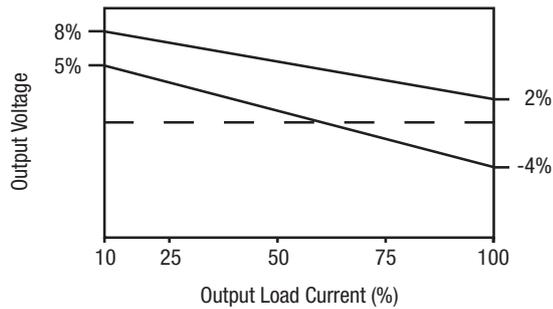
	Inductor			Capacitor C, µF
	L, µH	SMD	Through Hole	
NXJ2S0505MC	4.7	82472C	11R472C	10
NXJ2S1212MC	4.7	82472C	11R472C	4.7
NXJ2S1215MC	4.7	82472C	11R472C	4.7
NXJ2S2405MC	4.7	82472C	11R472C	10
NXJ2S2415MC	4.7	82472C	11R472C	4.7



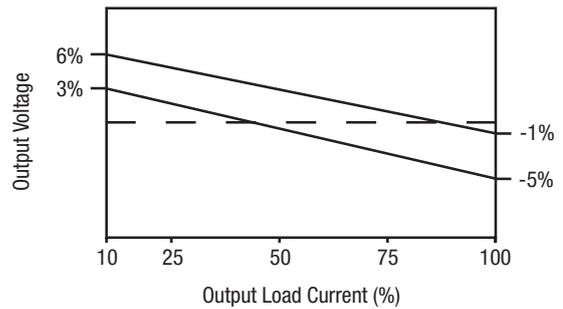
**TOLERANCE ENVELOPES**

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.

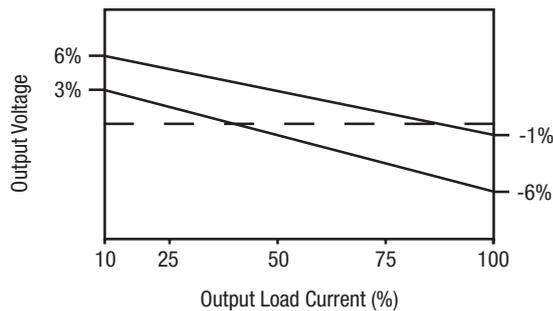
**NXJ2S0505MC**



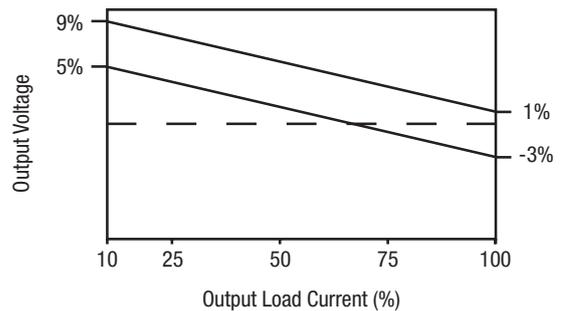
**NXJ2S1212MC**



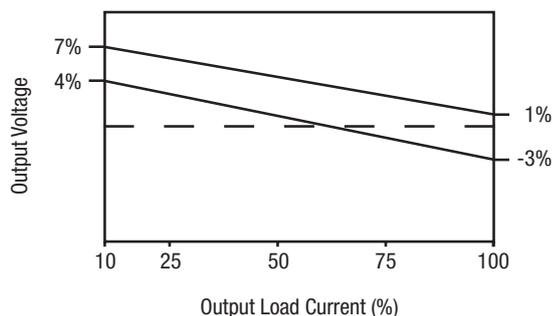
**NXJ2S1215MC**



**NXJ2S2405MC**

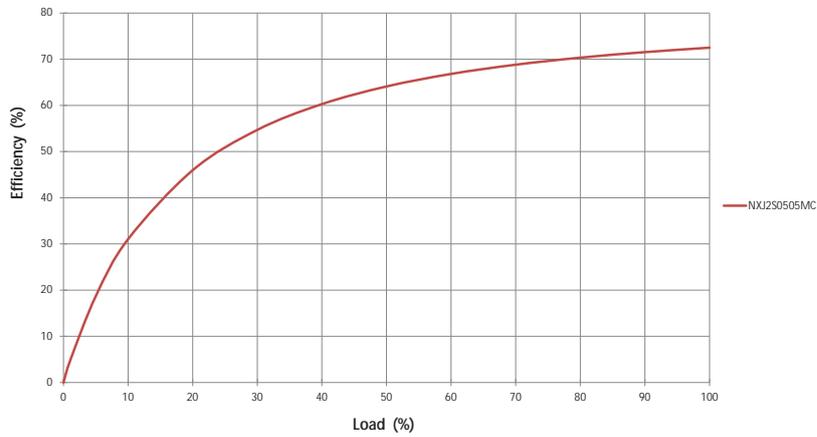


**NXJ2S2415MC**

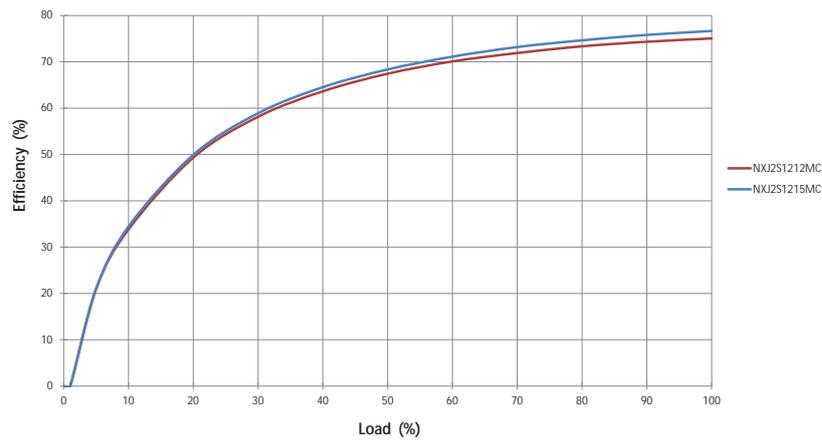


**EFFICIENCY VS LOAD**

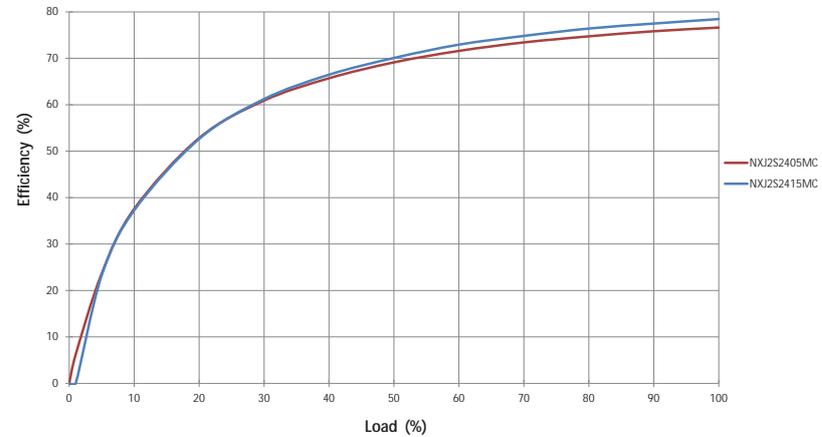
**5V Input**



**12V Input**

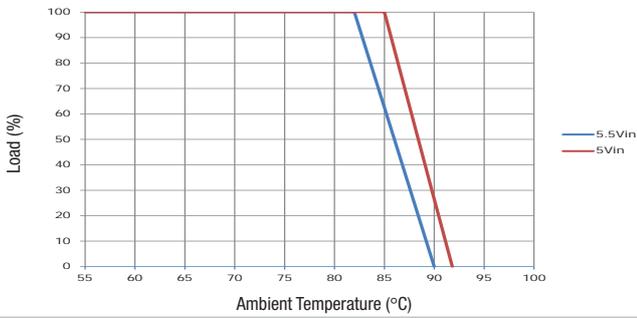


**24V Input**

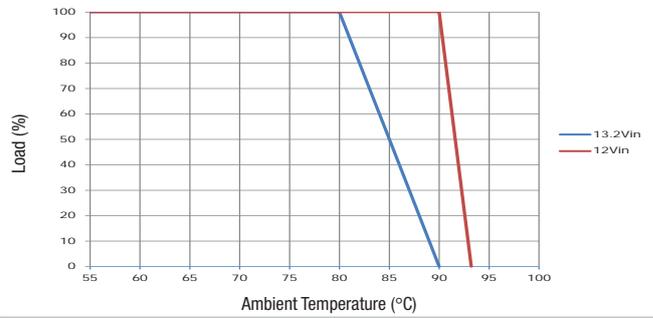


### TEMPERATURE DERATING

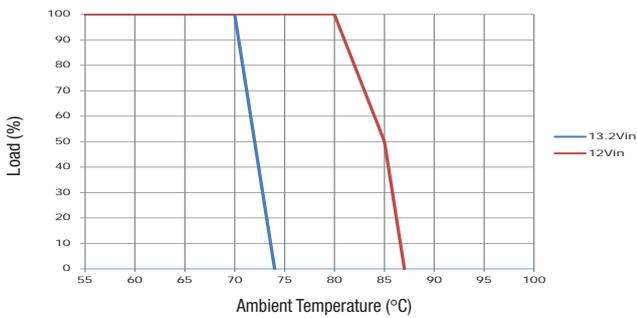
**NXJ2S0505MC**



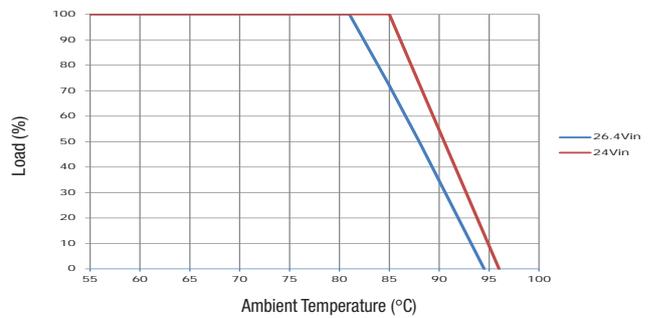
**NXJ2S1212MC**



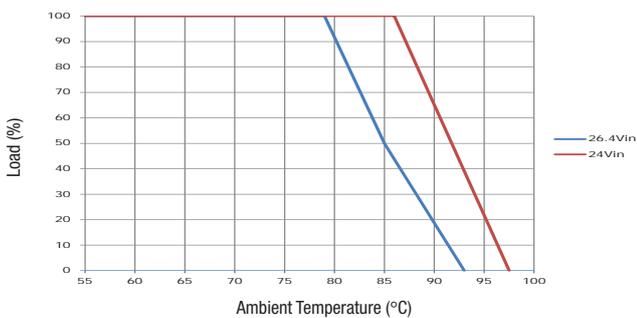
**NXJ2S1215MC**



**NXJ2S2405MC**



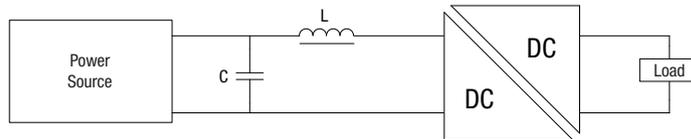
**NXJ2S2415MC**



**EMC FILTERING AND SPECTRA**

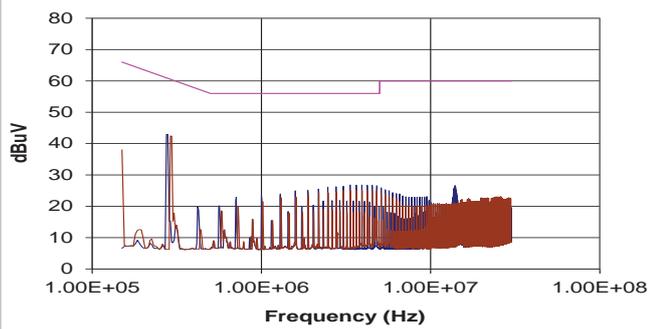
**FILTERING**

The following table shows the additional input capacitor and input inductor typically required to meet EN 55022 Curve A & B CISPR22 Average Limit as shown in the following plots. The following plots show positive and negative average limit and CISPR22 Average Limit A (pink line) and CISPR22 Average Limit B (green line) adherence limits. The below values are for guidance only and should be evaluated in the application circuit.

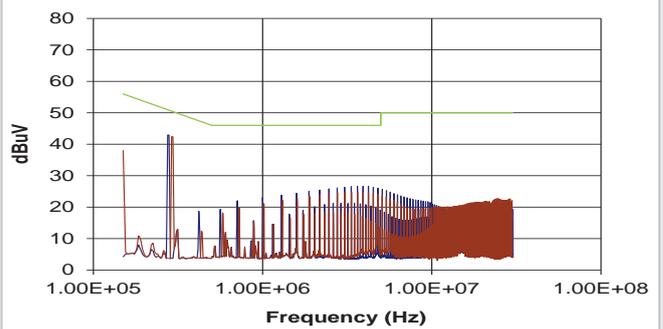


	Inductor			Capacitor	
	L, $\mu$ H	SMD	Through Hole	C, $\mu$ F	SMD
NXJ2S0505MC	10	84103C	11R103C	15	GRM55ER71E156KA01
NXJ2S1212MC	10	82103C	11R103C	15	GRM55ER71E156KA01
NXJ2S1215MC	10	82103C	11R103C	15	GRM55ER71E156KA01
NXJ2S2405MC	10	82103C	11R103C	15	KRM55LR7YA156KH01
NXJ2S2415MC	10	82103C	11R103C	15	KRM55LR7YA156KH01

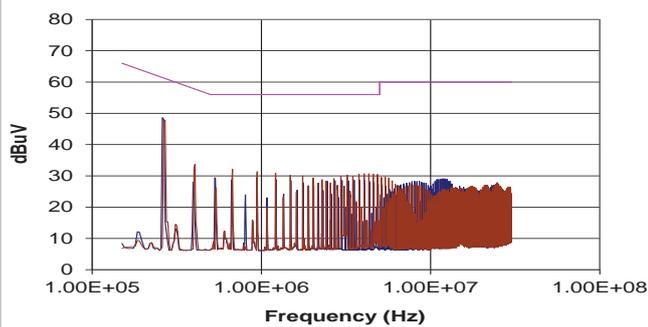
**NXJ2S0505MC (Quasi Peak)**



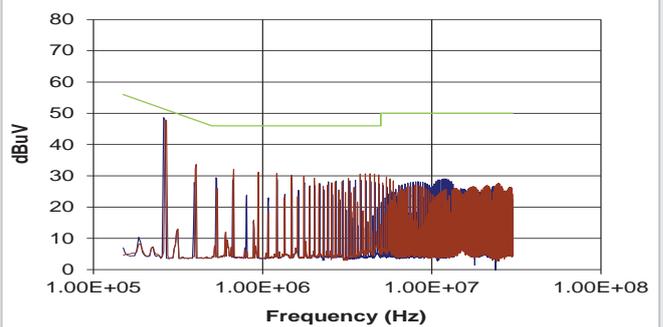
**NXJ2S0505MC (Average)**



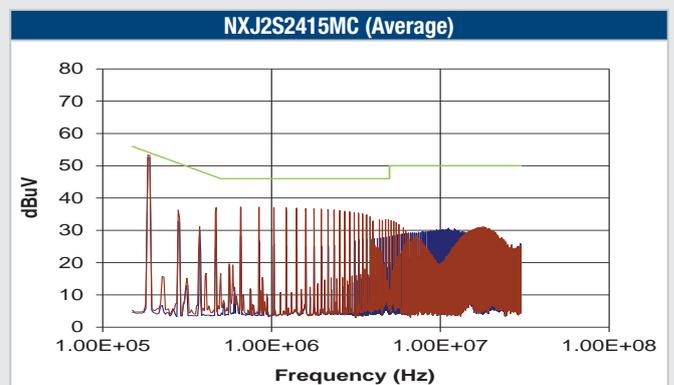
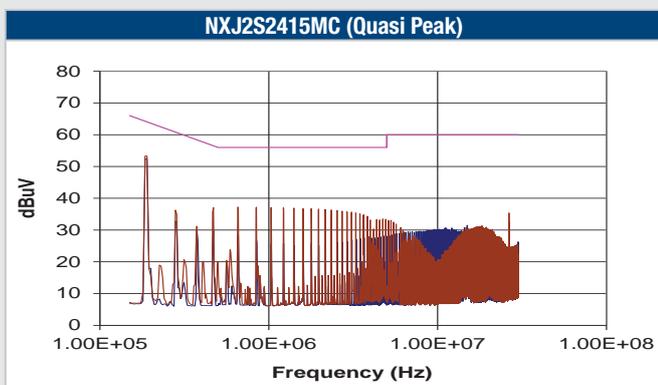
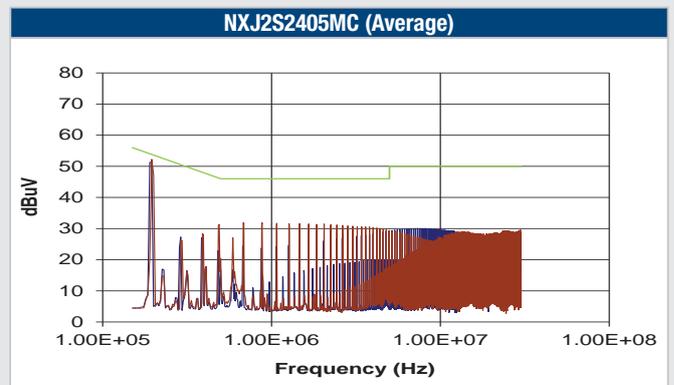
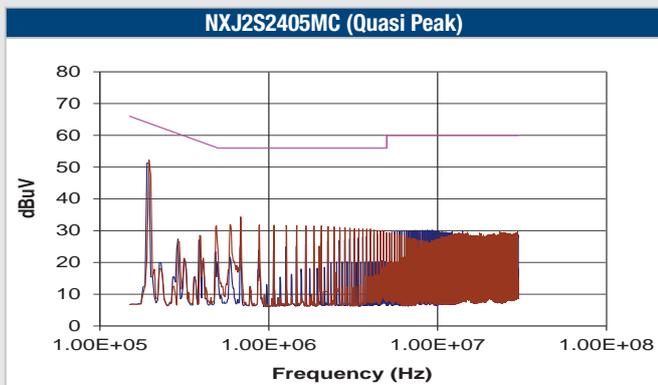
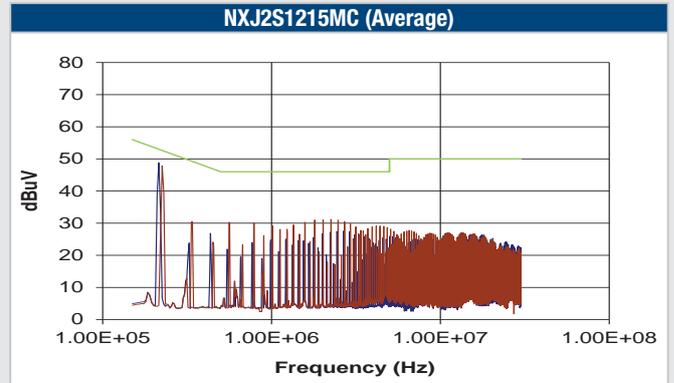
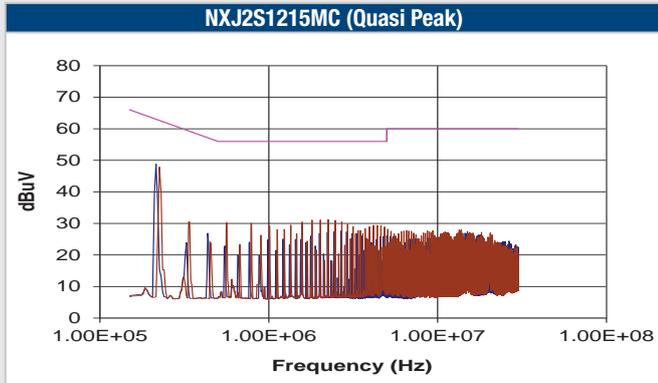
**NXJ2S1212MC (Quasi Peak)**



**NXJ2S1212MC (Average)**

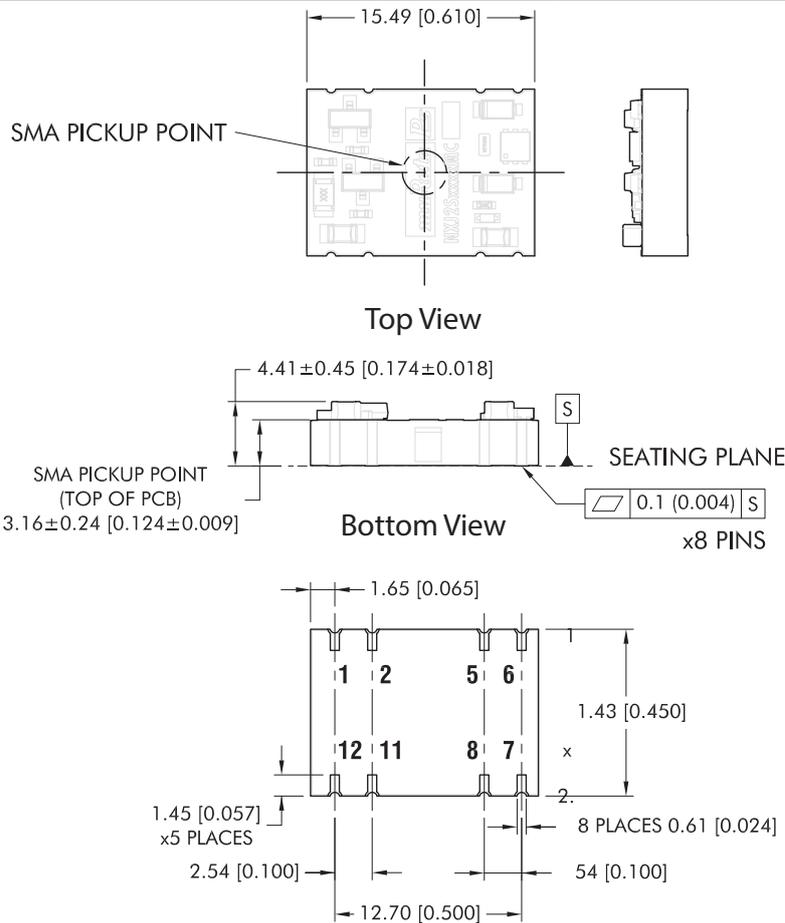


EMC FILTERING AND SPECTRA (Continued)



**PACKAGE SPECIFICATIONS**

Mechanical Dimensions - 5V & 12V Input Types



All dimensions in mm(inches). Controlling dimension is mm. Tolerances (unless otherwise stated) ±0.2 (0.008). Components shown for reference only

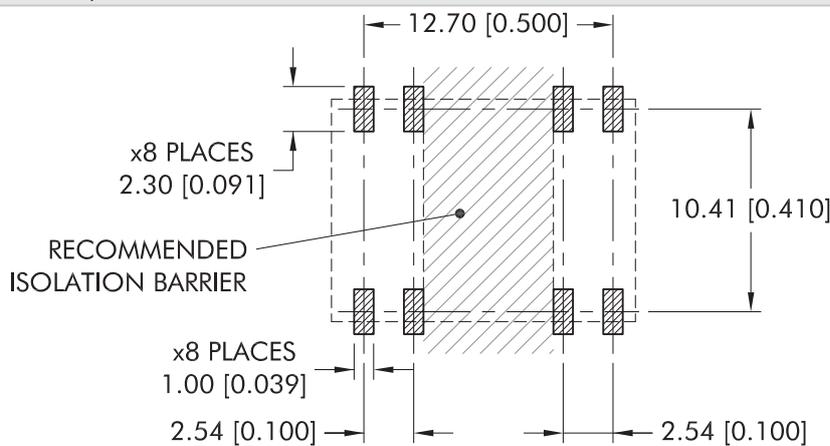
Weight: 1.38g

Pin Connections

Pin	Function
1	+VIN
2	-VIN
5	-VOUT
6	+VOUT
7	NC
8	NC
11	-VIN
12	NC

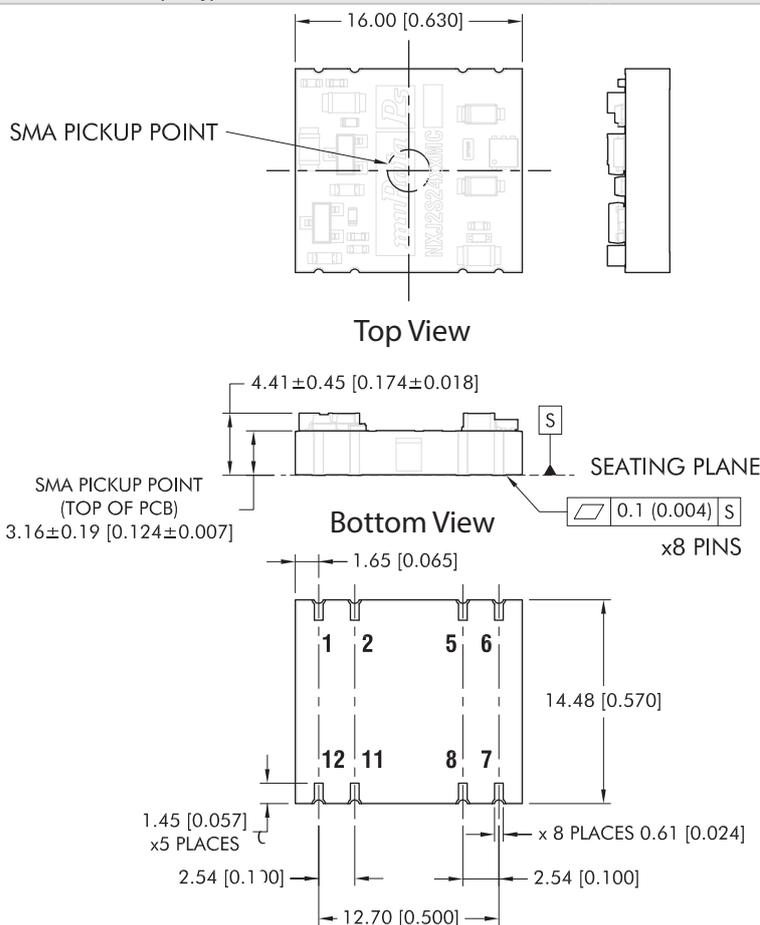
NC - No connection.

Recommended Footprint Details



**PACKAGE SPECIFICATIONS (Continued)**

**Mechanical Dimensions - 24V Input Type**



All dimensions in mm(inches). Controlling dimension is mm. Tolerances (unless otherwise stated)  $\pm 0.2$  (0.008). Components shown for reference only

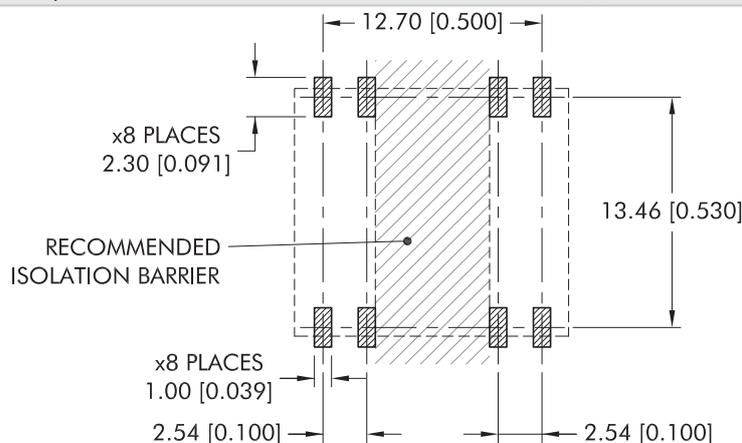
Weight: 1.78g

**Pin Connections**

Pin	Function
1	+VIN
2	-VIN
5	-VOUT
6	+VOUT
7	NC
8	NC
11	-VIN
12	NC

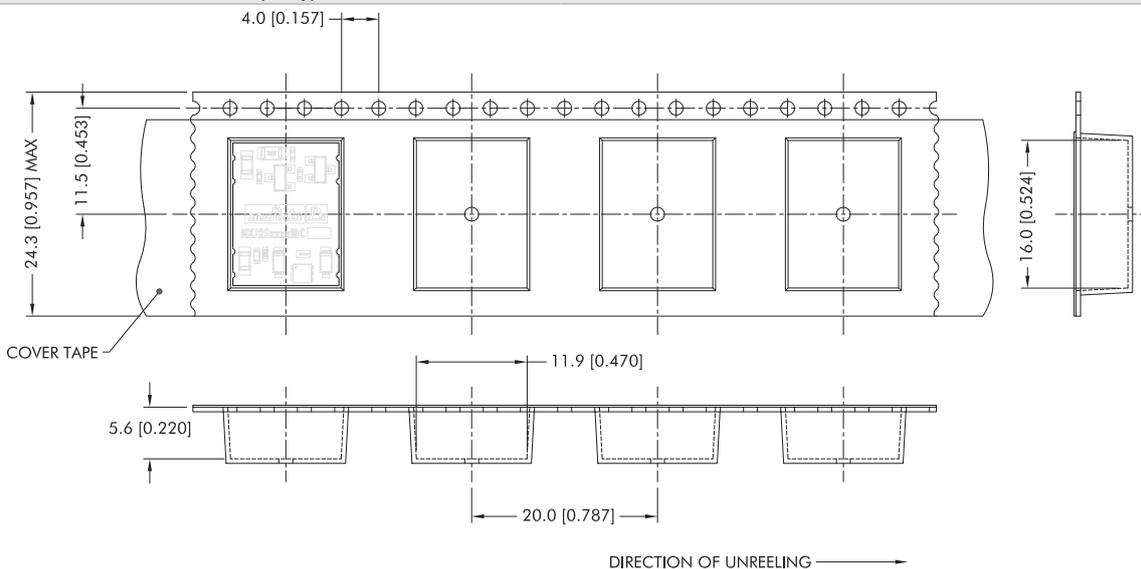
NC - No connection.

**Recommended Footprint Details**



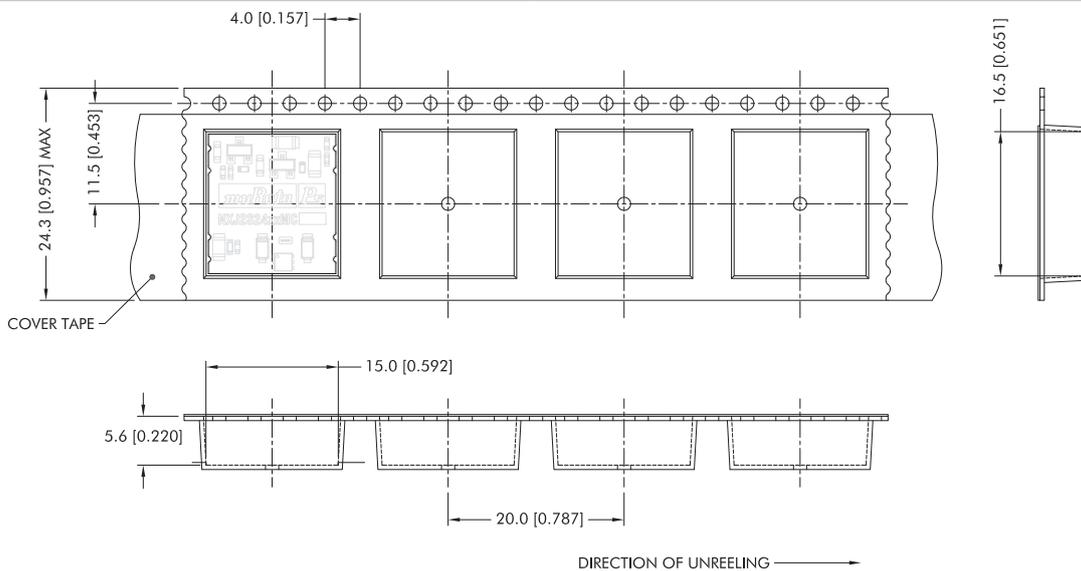
**TAPE & REEL SPECIFICATIONS**

**TAPE OUTLINE DIMENSIONS - 5V & 12V Input Types**



Tape & Reel specifications shall conform with current EIA-481 standard  
Unless otherwise stated all dimensions in mm(inches)  
Controlling dimension is mm  
Components shall be orientated within the carrier tape as indicated

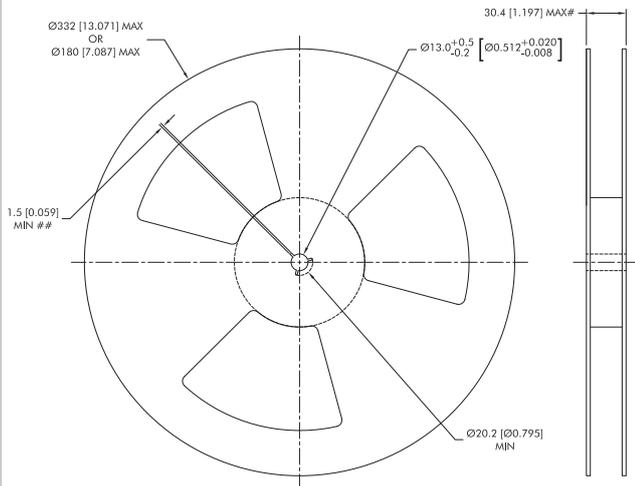
**TAPE OUTLINE DIMENSIONS - 24V Input Type**



Tape & Reel specifications shall conform with current EIA-481 standard  
Unless otherwise stated all dimensions in mm(inches)  
Controlling dimension is mm  
Components shall be orientated within the carrier tape as indicated

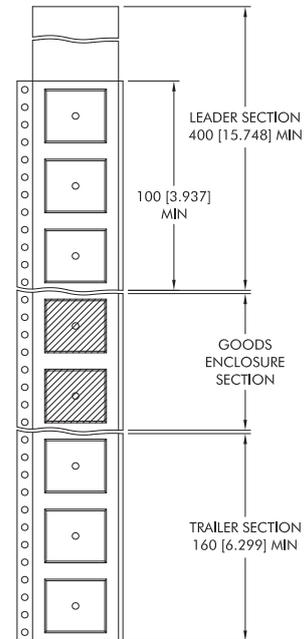
#### TAPE & REEL SPECIFICATIONS (Continued)

##### 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" - 135 or 13" - 600

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