



## FEATURES

- RoHS compliant
- Efficiency from 60.5%
- Wide temperature performance -40°C to 85°C
- UL 94V-0 Package material
- Lead frame technology
- 5V, 12V, & 24V Input
- 5V, 12V & 15V Output
- Internal SMD construction
- 1kVDC Isolation
- MTTF up to 1.4 million hours
- Power density 0.7W/cm<sup>3</sup>
- Multi layer ceramic capacitors

## PRODUCT DESCRIPTION

The NTF 1W series of surface mount DC/DC converters offer a tightly regulated output voltage in a true surface mount device, available with three wide input voltage ranges of 4-6V, 9-15V and 18-36V. The NTF series' employs leadframe technology and transfer moulding techniques to bring all of the benefits of IC style packaging to hybrid circuitry. Co-planarity of the lead positions is based upon IEC 191-6:1990. The devices are suitable for all applications where high volume production is envisaged.

## SELECTION GUIDE

| Order Code <sup>2</sup> | Input Voltage | Output Voltage | Output Current | Input Current |          |           | Efficiency |      | MTTF |
|-------------------------|---------------|----------------|----------------|---------------|----------|-----------|------------|------|------|
|                         | Nominal       |                | 100% Load      | 0% Load       | Shutdown | 100% Load | Min.       | Typ. |      |
|                         | V             | V              | mA             | mA            | μA       | mA        | %          | %    |      |
| NTFS0505MC              | 5             | 5              | 200            | 25            | 72       | 320       | 59.0       | 62   | 921  |
| NTFS0512MC              | 5             | 12             | 83             | 30            | 55       | 300       | 63.5       | 67   | 1118 |
| NTFS0515MC              | 5             | 15             | 66             | 60            | 80       | 320       | 60.5       | 63   | 869  |
| NTFS1205MC              | 12            | 5              | 200            | 10            | 70       | 110       | 68.0       | 73   | 1281 |
| NTFS1212MC              | 12            | 12             | 83             | 12            | 34       | 130       | 62.0       | 66   | 1175 |
| NTFS1215MC              | 12            | 15             | 66             | 15            | 33       | 120       | 62.0       | 66   | 1283 |
| NTFS2405MC              | 24            | 5              | 200            | 6             | 96       | 120       | 65.0       | 70   | 1379 |
| NTFS2412MC              | 24            | 12             | 83             | 8             | 48       | 60        | 65.0       | 68   | 1278 |
| NTFS2415MC              | 24            | 15             | 66             | 9             | 50       | 60        | 65.0       | 67   | 1223 |

## INPUT CHARACTERISTICS

| Parameter                | Conditions                            | Min. | Typ. | Max. | Units  |
|--------------------------|---------------------------------------|------|------|------|--------|
| Voltage range            | Continuous operation, 5V input types  | 4    | 5    | 6    | V      |
|                          | Continuous operation, 12V input types | 9    | 12   | 15   |        |
|                          | Continuous operation, 24V input types | 18   | 24   | 36   |        |
| Reflected ripple current | xx05 output types                     |      | 12   |      | mA p-p |
|                          | xx12 output types                     |      | 6    |      |        |
|                          | xx24 output types                     |      | 6    |      |        |

## OUTPUT CHARACTERISTICS

| Parameter                  | Conditions   | Min. | Typ. | Max. | Units             |
|----------------------------|--|------|------|------|-------------------|
| Voltage set point accuracy | With external input/output capacitors                        |      | ±1   | ±2   | %                 |
| Line regulation            | Low line to high line,                                       |      | 0.2  | 1    | %                 |
| Load regulation            | 10% load to 100% load, with external input/output capacitors |      | 0.1  | 1    | %                 |
| Ripple & Noise             | BW=DC to 20MHz, all output types                             |      | 100  | 150  | mV p-p            |
| Voltage trim range         |  | -10  |      | +10  | %V <sub>OUT</sub> |

## GENERAL CHARACTERISTICS

| Parameter           | Conditions | Min. | Typ. | Max. | Units |
|---------------------|------------|------|------|------|-------|
| Switching frequency |            | 50   |      | 700  | kHz   |

## ABSOLUTE MAXIMUM RATINGS

|   |       |
|---|-------|
| Short-circuit protection                        | 15s   |
| Lead temperature 1.5mm from case for 10 seconds | 245°C |
| Input voltage V <sub>IN</sub> , NTF05 types     | 10V   |
| Input voltage V <sub>IN</sub> , NTF12 types     | 17.5V |
| Input voltage V <sub>IN</sub> , NTF24 types     | 40V   |

1 Calculated using MIL-HDBK-217F with nominal input voltage at full load (ground benign) at 25°C.

2 If components are required in tape and reel format suffix order code with -R, e.g. NTF0505MC-R.

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 |
|-------------------------------------|---------------------|------|------|------|-------|
| Operation                           | See derating graphs | -40  |      | 85   |       |
| Storage                             |                     | -50  |      | 130  |       |
| Cooling                             | Free air convection |      |      |      |       |
| Case temperature rise above ambient |                     |      | 30   |      | °C    |

### ISOLATION CHARACTERISTICS

| Parameter              | Conditions                | Min. | Typ. | Max. | Units |
|------------------------|---------------------------|------|------|------|-------|
| Isolation test voltage | Flash tested for 1 second | 1000 |      |      | VDC   |
| Resistance             | Viso= 500VDC              | 1    | 10   |      | GΩ    |
| Capacitance            |                           |      | 25   |      | pF    |

### 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 NTF series of DC/DC converters are all 100% production tested at their stated isolation voltage. This is 1kVDC for 1 second.

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

For a part holding no specific agency approvals, such as the NTF series, both input and output should normally be maintained within SELV limits i.e. less than 42.4V peak, or 60VDC. The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an element of a safety isolation system. The part could be expected to function correctly with several hundred volts offset applied continuously across the isolation barrier; but then the circuitry on both sides of the barrier must be regarded as operating at an unsafe voltage and further isolation/insulation systems must form a barrier between these circuits and any user-accessible circuitry according to safety standard requirements.

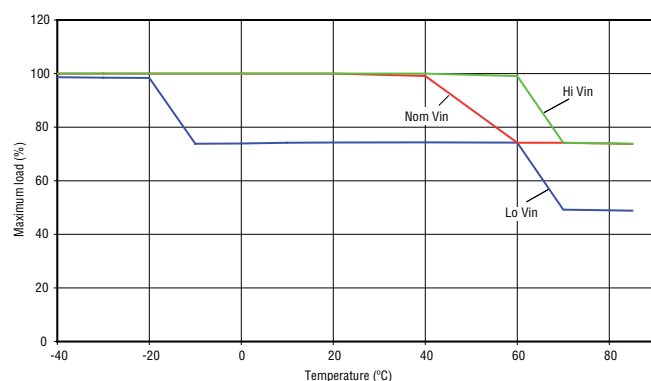
#### REPEATED HIGH-VOLTAGE ISOLATION TESTING

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 NTF series has toroidal isolation transformers, with no additional insulation between primary and secondary windings of enameled wire. While parts can be expected to withstand several times the stated test voltage, the isolation capability does depend on the wire insulation. Any material, including this enamel (typically polyurethane) 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 be reduced by 20% from specified test voltage.

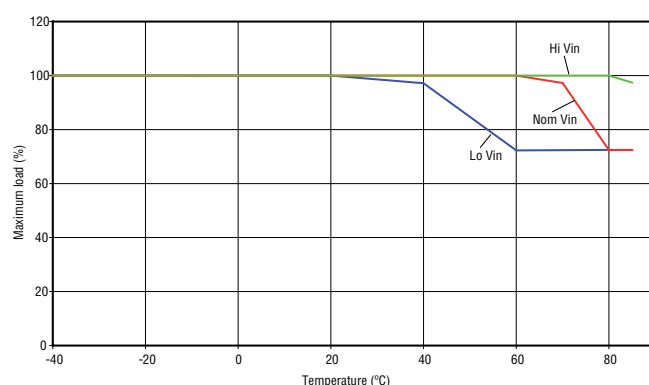
This consideration equally applies to agency recognized parts rated for better than functional isolation where the wire enamel insulation is always supplemented by a further insulation system of physical spacing or barriers.

## TEMPERATURE DERATING

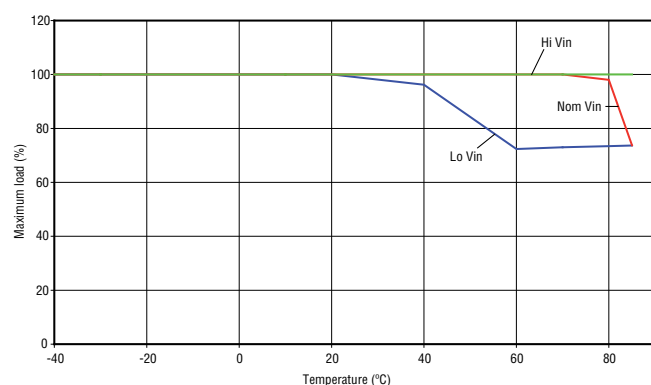
**NTFS0505**



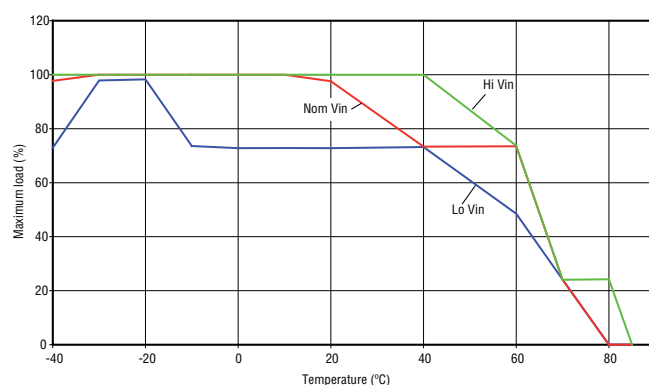
**NTFS0512**



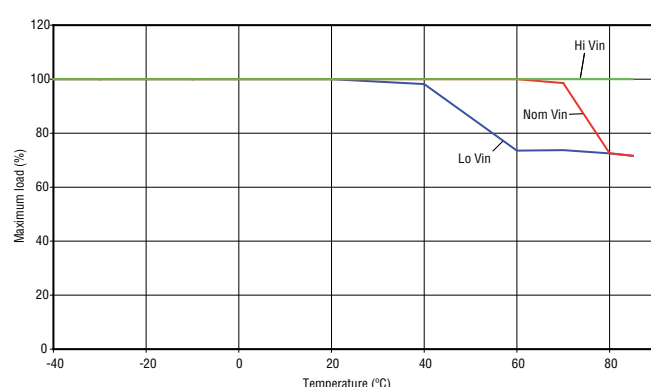
**NTFS0515**



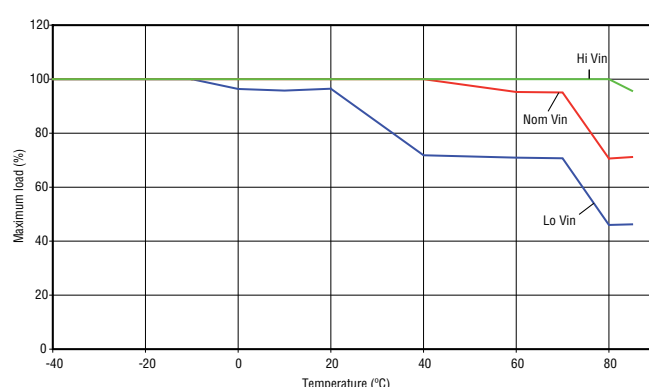
**NTFS1205**



**NTFS1212**

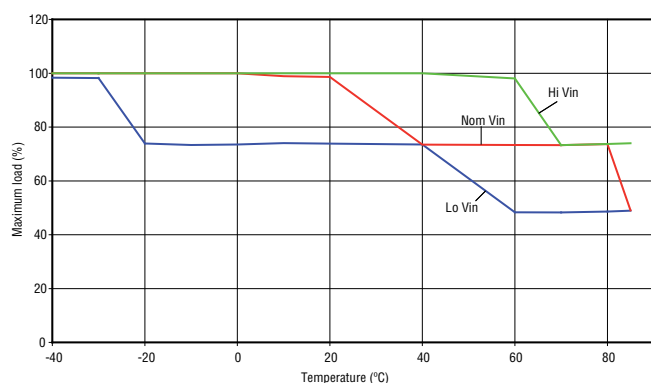


**NTFS1215**

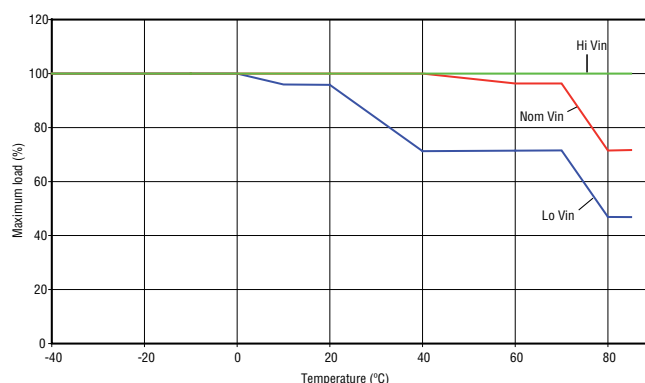


## TEMPERATURE DERATING

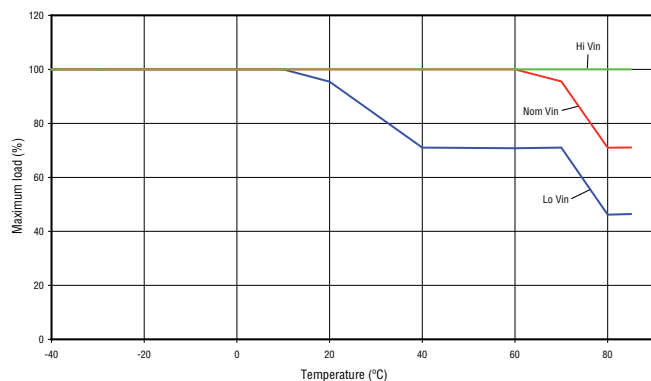
**NTFS2405**



**NTFS2412**



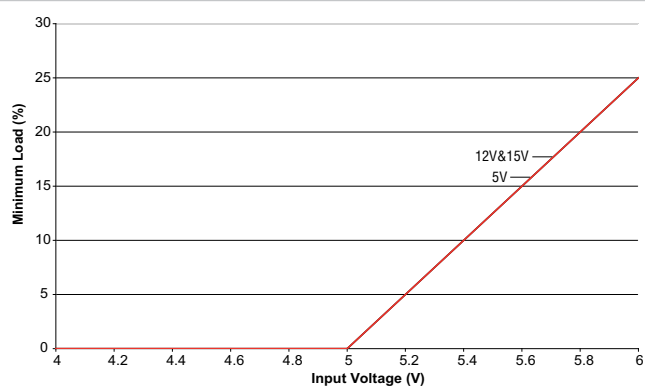
**NTFS2415**



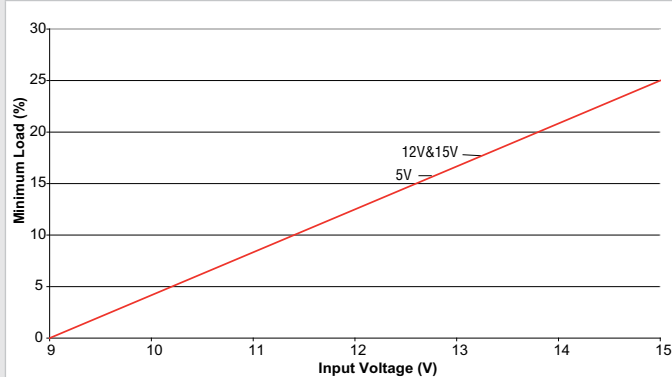
### MINIMUM LOAD

The graphs show the minimum load to meet datasheet specification. The NTF series will operate to zero load, however, the NTF series may not meet all datasheet specifications.

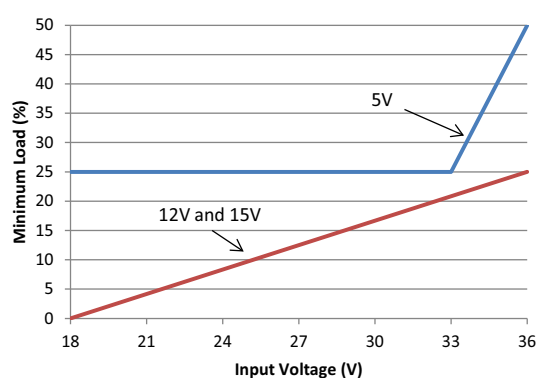
**NTFS05XX**



**NTFS12XX**



**NTFS24XX**



### RoHS COMPLIANCE INFORMATION



This series is compatible with RoHS soldering systems with a peak reflow solder temperature of 245°C and time above liquidus of 217°C for 60 seconds. The pin termination finish on this product series is Gold, plating thickness 0.05 microns minimum. The series is backward compatible with Sn/Pb soldering systems. For further information, please visit [www.murata-ps.com/rohs](http://www.murata-ps.com/rohs)

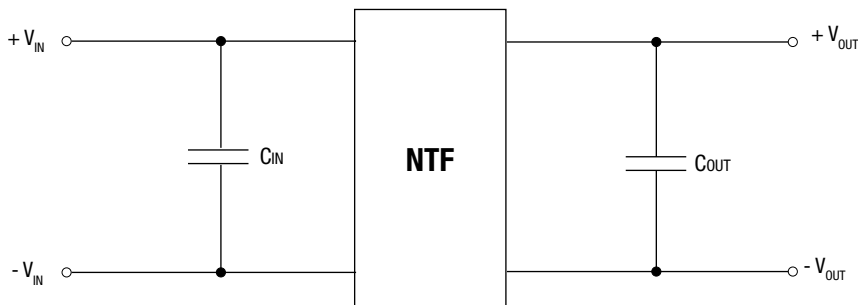
### APPLICATION NOTES

#### Recommended input & output capacitors

Although these converters will work without external capacitors, they are necessary in order to guarantee the full parametric performance over the full line and load range. All parts have been tested and characterized using the following values and test circuit.

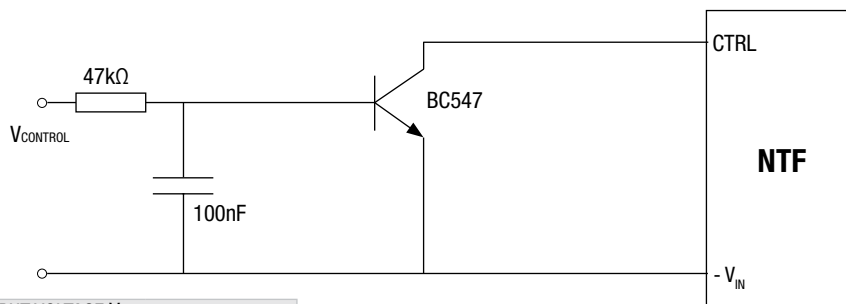
| Value                                |                                     |
|--------------------------------------|-------------------------------------|
| C <sub>IN</sub>                      | C <sub>OUT</sub>                    |
| 10μF, 200V<br>good low esr capacitor | 22μF, 16V<br>good low esr capacitor |

#### Test circuit, 5V, 12V and 15V output



#### ON/OFF Pin

This provides an OFF function, which puts the converter into a low power mode. When the pin is un-connected, the converter is on. The circuit used must be able to sink a peak current of 50mA to guarantee turning the converter off. The circuit should be an open collector arrangement, an example circuit is shown below. Voltages should not be applied directly to the ON/OFF pin. The BC547 should be fitted close to the NTF ON/OFF pin to prevent the addition of excess wiring capacitance.



CONTROL PIN CIRCUIT INPUT VOLTAGE V<sub>CONTROL</sub>

|            | Min. | Max. | Units |
|------------|------|------|-------|
| Module ON  | 0    | 0.2  | V     |
| Module OFF | 1.6  | 30   | V     |

#### Output voltage adjustment

The trim resistor equations are:

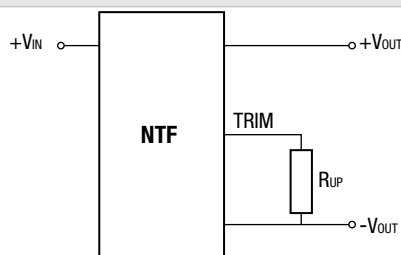
$$R_{DOWN} = \left[ \frac{(V_{DOWN} - L) \times G}{V_{NOM} - V_{DOWN}} \right]$$

$$R_{UP} = \left[ \frac{G \times L}{V_{UP} - L - K} \right]$$

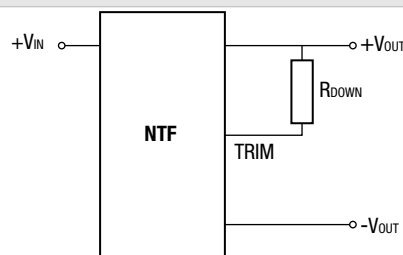
Where:

|                        | G      | L    | K    |
|------------------------|--------|------|------|
| NTFS0505MC             | 30100  | 1.24 | 3.76 |
| NTFS1205MC, NTFS2405MC | 100000 | 1.24 | 3.76 |
| NTFSXX12MC             | 38300  | 2.5  | 9.5  |
| NTSFX15MC              | 49900  | 2.5  | 12.5 |

#### TRIM UP



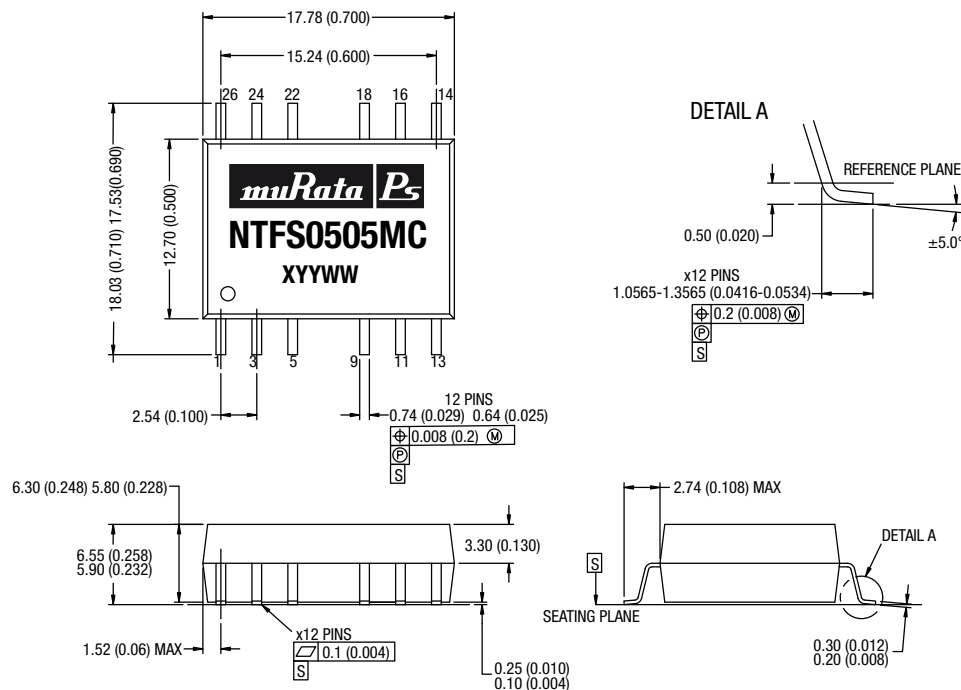
#### TRIM DOWN



When the output voltage is trimmed up, output current must be derated so that the maximum output power is not exceeded.

## PACKAGE SPECIFICATIONS

### MECHANICAL DIMENSIONS



All dimensions in mm  $\pm 0.25$ mm (inches  $\pm 0.01$ ). All pins on a 2.54 (0.1) pitch.

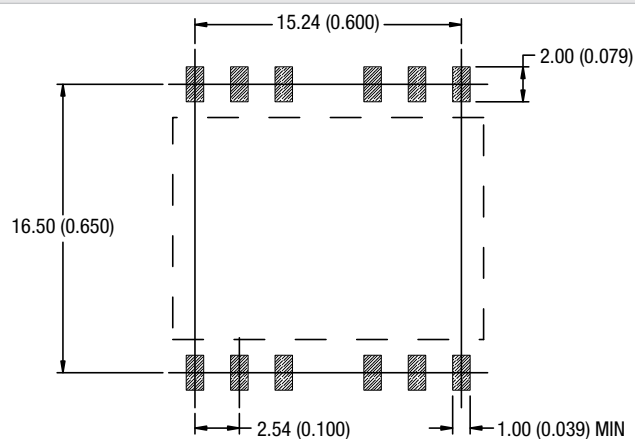
Weight: 2.8g

### PIN CONNECTIONS

| Pin | Function          |
|-----|-------------------|
| 1   | -V <sub>IN</sub>  |
| 3   | +V <sub>IN</sub>  |
| 5   | NA                |
| 9   | NA                |
| 11  | -V <sub>OUT</sub> |
| 13  | +V <sub>OUT</sub> |
| 14  | NA                |
| 16  | TRIM              |
| 18  | NA                |
| 22  | ON/OFF            |
| 24  | NA                |
| 26  | NA                |

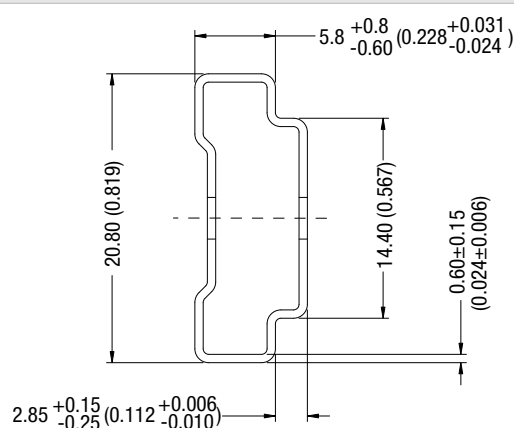
NA - Not available for electrical connection.

### RECOMMENDED FOOTPRINT DETAILS



All dimensions in mm  $\pm 0.5$  (inches  $\pm 0.02$ )

### TUBE OUTLINE DIMENSIONS

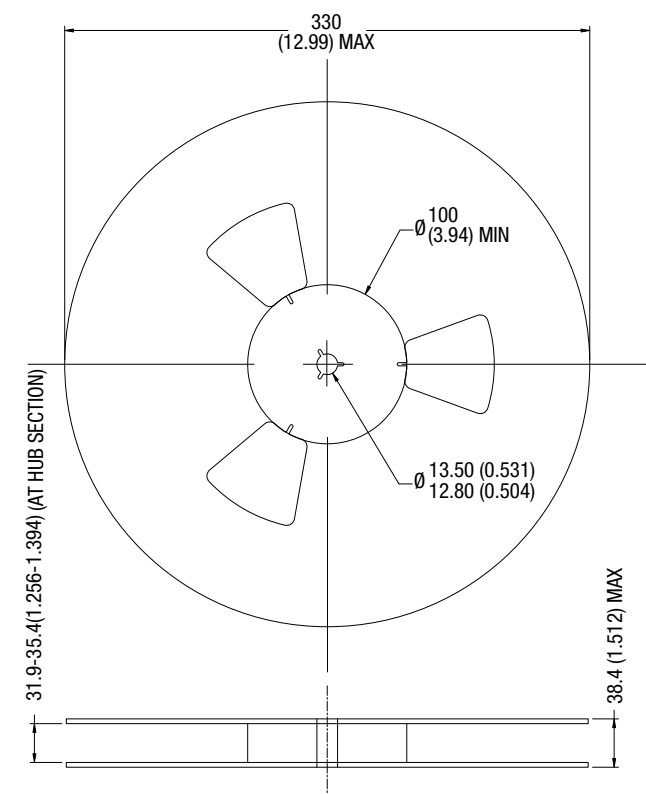


All dimensions in mm  $\pm 0.5$  (inches  $\pm 0.02$ ).  
Tube length : 475  $\pm$  2.0 (18.70  $\pm$  0.079).

Tube Quantity : 25

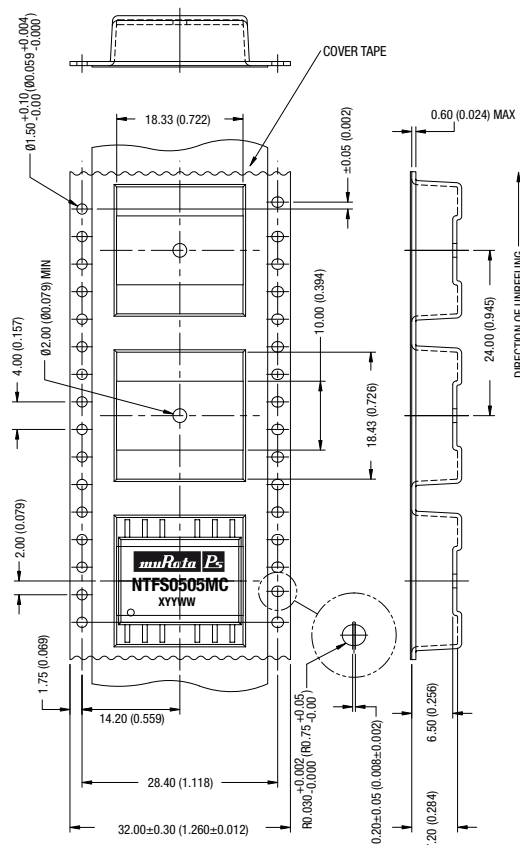
### TAPE & REEL SPECIFICATIONS

#### REEL OUTLINE DIMENSIONS



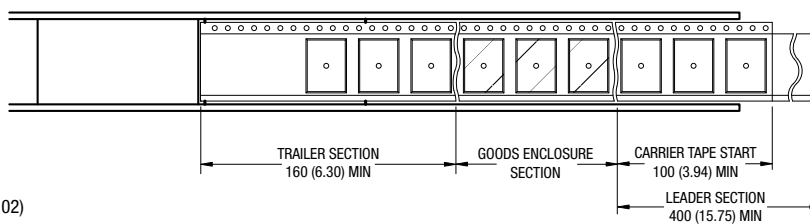
All dimensions in mm±0.5 (inches ±0.02)

#### TAPE OUTLINE DIMENSIONS



All dimensions in mm±0.5 (inches ±0.02)

#### REEL PACKAGING DETAILS



All dimensions in mm±0.5 (inches ±0.02)  
Reel Quantity : 400

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ISO 9001 and 14001 REGISTERED



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Refer to: <http://www.murata-ps.com/requirements/>

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