# MTE1 Series

## Isolated 1W Single Output SM DC/DC Converters

Murata Power Solutions


## FEATURES

- Single isolated output
- 1kVDC Isolation
- Typical efficiency 86%
- Wide temperature performance at full 1 Watt load, –40°C to 85°C
- UL 94V-0 Package material
- 3.3V, 5V, 12V, 15V & 24V Input
- 3.3V, 5V, 9V, 12V & 15V Output
- Internal SMD construction
- Toroidal magnetics

## PRODUCT OVERVIEW

The MTE1 series is a new range of surface mount, high performance 1W DC-DC converters. The MTE1 series is the new high performance version of our 1W NTE series, the MTE1 series is more efficient and offers improved regulation performance. The MTE1 series offers 1W of available output power over the full industrial temperature range of -40ºC to 85ºC.

The MTE1 series has a MSL rating 1, and is compatible with a peak reflow solder temperature of 245˚C as per J-STD-020D.

## SELECTION GUIDE

| Order Code[1] | Nominal Input Voltage | Output Voltage | Output Current | Input Current at Rated Load (Typ.) | Load Regulation (Typ.) | Load Regulation (Max) | Output Ripple & Noise (Typ.) | Efficiency (Min.) | Efficiency (Typ.) | Isolation Capacitance | MTTF[2] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | V | mA | mA | % | % | mVp-p | % | % | pF | kHrs |
| **MTE1S0303MC** | 3.3 | 3.3 | 303 | 382 | 11 | 13.5 | 33 | 75 | 78 | 15 | TBC |
| **MTE1S0305MC** | 3.3 | 5 | 200 | 363 | 8.5 | 11 | 24 | 79 | 82 | 16 | |
| **MTE1S0309MC** | 3.3 | 9 | 111 | 353 | 7 | 9 | 17 | 82 | 85 | 21 | |
| **MTE1S0312MC** | 3.3 | 12 | 83 | 348 | 6.5 | 8 | 15 | 83 | 86 | 20 | |
| **MTE1S0315MC** | 3.3 | 15 | 67 | 346 | 6 | 8 | 13 | 83 | 86 | 20 | |
| **MTE1S0503MC** | 5 | 3.3 | 303 | 248 | 9 | 12 | 24 | 77 | 79 | 21 | |
| **MTE1S0505MC** | 5 | 5 | 200 | 239 | 6.5 | 8 | 20 | 79 | 82 | 22 | |
| **MTE1S0506MC** | 5 | 6 | 167 | 236 | 6 | 7.5 | 20 | 81 | 84 | 24 | |
| **MTE1S0509MC** | 5 | 9 | 111 | 233 | 5 | 6.5 | 15 | 83 | 85 | 26 | |
| **MTE1S0512MC** | 5 | 12 | 83 | 227 | 5 | 6.5 | 14 | 84 | 87 | 29 | |
| **MTE1S0515MC** | 5 | 15 | 67 | 225 | 5 | 6.5 | 11 | 85 | 88 | 33 | |
| **MTE1S1205MC** | 12 | 5 | 200 | 97 | 5 | 7 | 19 | 81 | 84 | 24 | |
| **MTE1S1209MC** | 12 | 9 | 111 | 95 | 3 | 4.5 | 13 | 82 | 86 | 29 | |
| **MTE1S1212MC** | 12 | 12 | 83 | 93 | 3 | 4.5 | 12 | 85 | 88 | 43 | |
| **MTE1S1215MC** | 12 | 15 | 67 | 93 | 3 | 4 | 11 | 85 | 88 | 40 | |
| **MTE1S1505MC** | 15 | 5 | 200 | 79 | 4 | 5.5 | 15 | 80 | 83 | 25 | |
| **MTE1S1509MC** | 15 | 9 | 111 | 77 | 3 | 4 | 9 | 81 | 86 | 38 | |
| **MTE1S1512MC** | 15 | 12 | 83 | 76 | 2.5 | 4 | 10 | 82 | 87 | 45 | |
| **MTE1S1515MC** | 15 | 15 | 67 | 75 | 2.5 | 4 | 8 | 84 | 88 | 57 | |
| **MTE1S2405MC** | 24 | 5 | 200 | 50 | 4 | 5.5 | 20 | 79 | 83 | 21 | |
| **MTE1S2409MC** | 24 | 9 | 111 | 48 | 2.5 | 4 | 19 | 84 | 86 | 31 | |
| **MTE1S2412MC** | 24 | 12 | 83 | 48 | 2 | 3.5 | 19 | 83 | 87 | 29 | |
| **MTE1S2415MC** | 24 | 15 | 67 | 48 | 2 | 3.5 | 22 | 85 | 88 | 46 | |

## INPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Voltage range | Continuous operation, 3.3V input types | 2.97 | 3.3 | 3.63 | V |
| | Continuous operation, 5V input types | 4.5 | 5.0 | 5.5 | |
| | Continuous operation, 12V input types | 10.8 | 12.0 | 13.2 | |
| | Continuous operation, 15V input types | 13.5 | 15.0 | 16.5 | |
| | Continuous operation, 24V input types | 21.6 | 24 | 26.4 | |
| Reflected ripple current | | | 5 | 15 | mA p-p |

## ISOLATION CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Isolation voltage | Flash tested for 1 second | 1000 | | | VDC |
| Resistance | Viso= 1000VDC | 20 | | | GΩ |

## GENERAL CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Switching frequency | All output types | | 80 | | Hz |

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Input voltage $V_{IN}$, MTE03 types | 5.5V |
| Input voltage $V_{IN}$, MTE05 types | 7V |
| Input voltage $V_{IN}$, MTE12 types | 15V |
| Input voltage $V_{IN}$, MTE15 types | 18V |
| Input voltage $V_{IN}$, MTE24 types | 28V |

1. If components are required in tape and reel format suffix order code with -R, e.g. MTE0505MC-R.
2. Calculated using MIL-HDBK-217 FN2 calculation model 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.

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RoHS COMPLIANT

For full details go to
www.murata-ps.com/rohs

## OUTPUT CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Rated power | $T_A$=-40°C to 85°C | | | 1.0 | W |
| Voltage set point accuracy | See tolerance envelope | | | | |
| Line regulation | High $V_{IN}$ to low $V_{IN}$ | | 1.1 | 1.2 | %/% |
| Ripple and noise | BW=DC to 20MHz | | 25 | 70 | mV p-p |

## TEMPERATURE CHARACTERISTICS

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Specification | All output types | -40 | | 85 | °C |
| Storage | | -50 | | 130 | |
| Case temperature rise above ambient | All output types | | 12.5 | 20 | |
| Cooling | Free air convection | | | | |

## 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 MTE 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?"

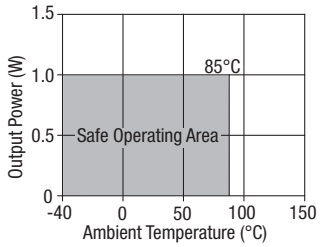
For a part holding no specific agency approvals, such as the MTE series, both input and output should normally be maintained within SELV limits i.e. less than 42.4V peak, or 60VDC. The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as an 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 MTE 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.

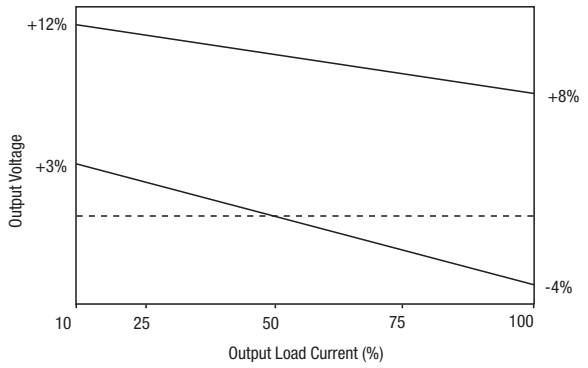
## TEMPERATURE DERATING GRAPH



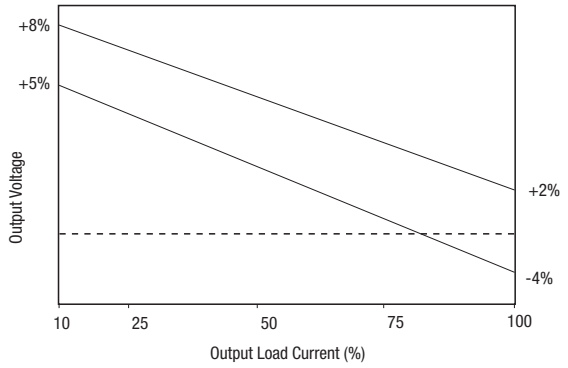
## TOLERANCE ENVELOPES

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.

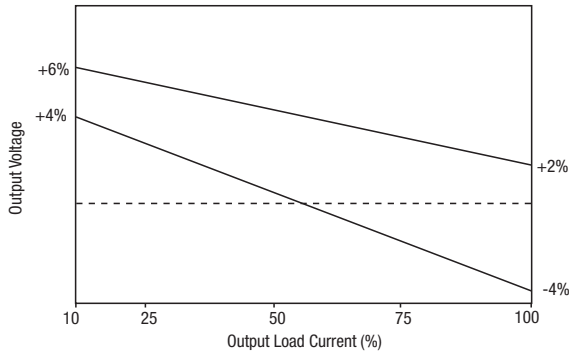
### 0303, 0503



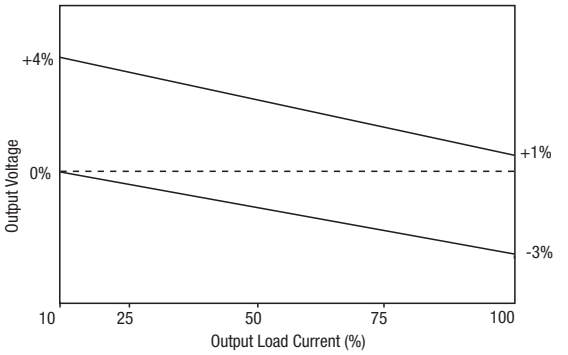

### 0305,0309



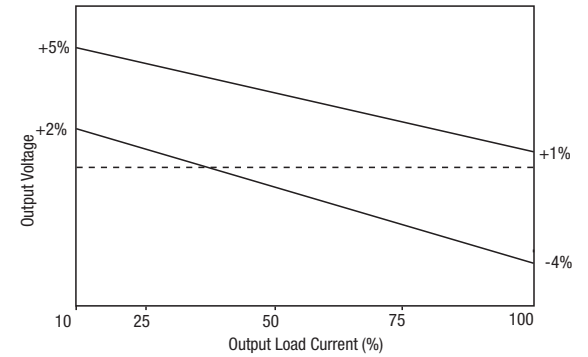

### 0312, 0315, 0505, 0506, 0509



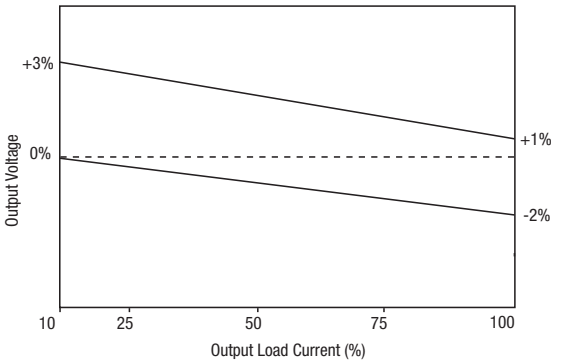

### 1209, 1212, 1505




### 0512, 0515, 1205,2405

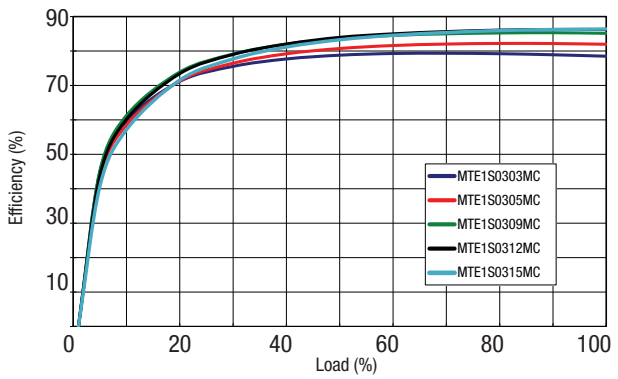



### 1215, 1509, 1512, 1515, 2409, 2412, 2415

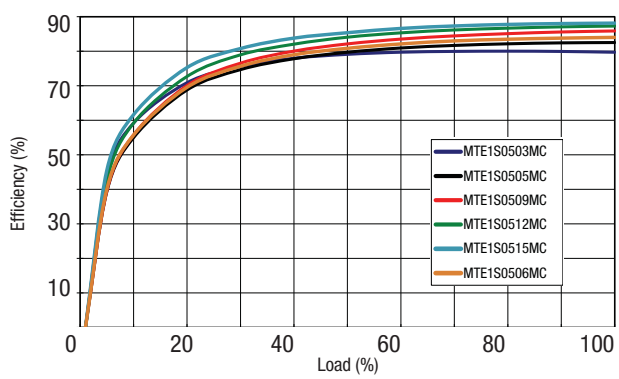


## EFFICIENCY VS LOAD

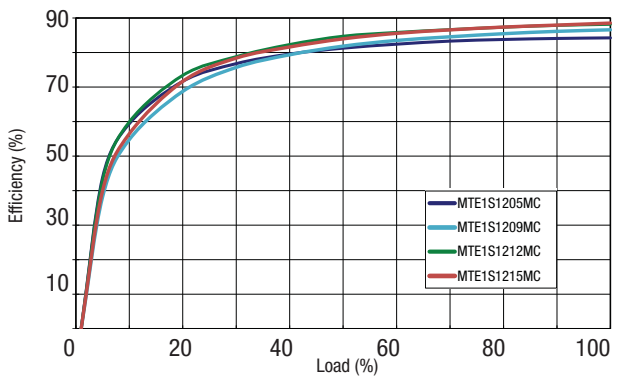
### 3.3V Input



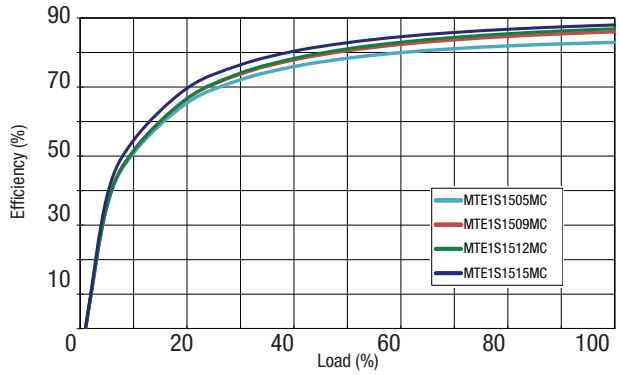

### 5V Input



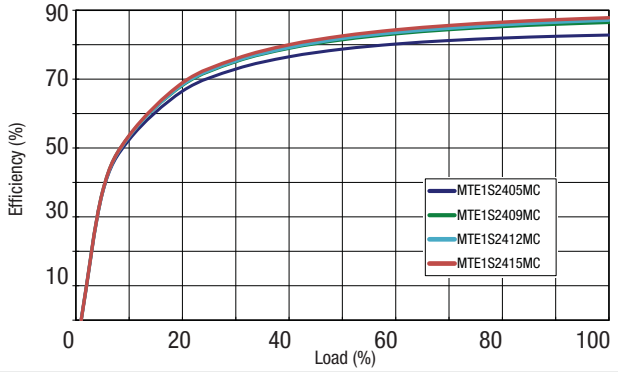

### 12V Input




### 15V Input




### 24V Input




## RoHS COMPLIANCE, MSL AND PSL INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems and is also backward compatible with Sn/Pb soldering systems. The MTE series has a process, moisture, and reflow sensitivity classification of MSL1 PSL R7F as defined in J-STD-020 and J-STD-075. This translates to: MSL1 = unlimited floor life, PSL R7F = Peak reflow temperature 245°C with a limitation on the time above liquidus (217°C) which for this series is 60sec max. The pin termination finish on this product series is Gold with a plating thickness of 0.05 microns minimum.

For further information please visit www.murata-ps.com/rohs

## 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%.

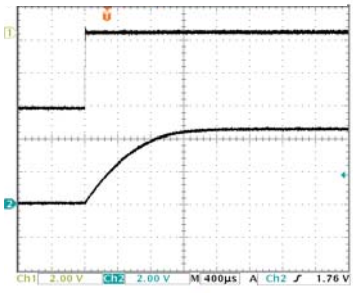
### Capacitive loading and start up

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. The product series will start into a capacitance of 47µF with an increased start time, however, the maximum recommended output capacitance is 10µF.

| | Start-up time |
|---|---|
| | µs |
| MTE1S0303MC | TBC |
| MTE1S0305MC | TBC |
| MTE1S0309MC | TBC |
| MTE1S0312MC | TBC |
| MTE1S0315MC | TBC |
| MTE1S0503MC | TBC |
| MTE1S0505MC | TBC |
| MTE1S0506MC | TBC |

| | Start-up time |
|---|---|
| | µs |
| MTE1S0509MC | TBC |
| MTE1S0512MC | TBC |
| MTE1S0515MC | TBC |
| MTE1S1205MC | TBC |
| MTE1S1209MC | TBC |
| MTE1S1212MC | TBC |
| MTE1S1215MC | TBC |
| MTE1S1505MC | TBC |

| | Start-up time |
|---|---|
| | µs |
| MTE1S1509MC | TBC |
| MTE1S1512MC | TBC |
| MTE1S1515MC | TBC |
| MTE1S2405MC | TBC |
| MTE1S2409MC | TBC |
| MTE1S2412MC | TBC |
| MTE1S2415MC | TBC |



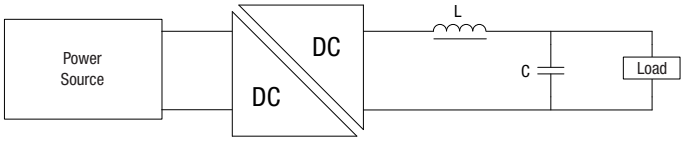

### Output Ripple Reduction

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.



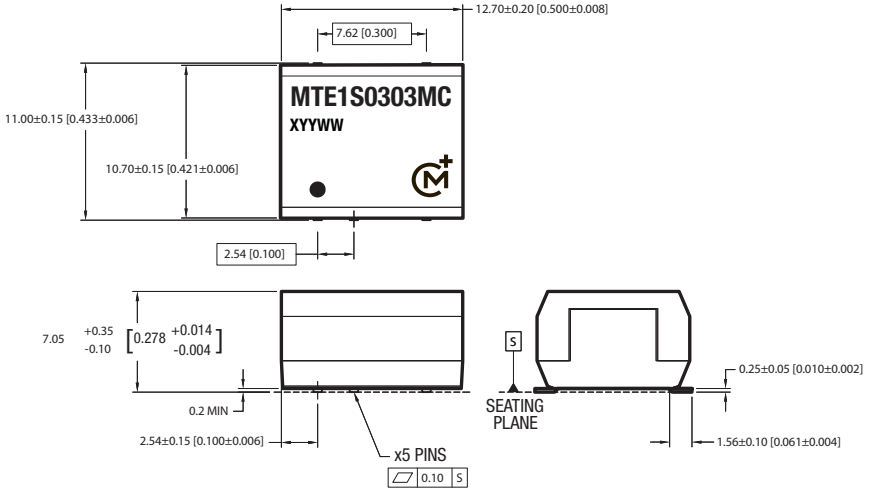

Typical Start-Up Wave Form

| | Inductor | | | Capacitor |
|---|---|---|---|---|
| | L, µH | SMD | Through Hole | C, µF |
| MTE1S0303MC | TBC | TBC | TBC | TBC |
| MTE1S0305MC | TBC | TBC | TBC | TBC |
| MTE1S0309MC | TBC | TBC | TBC | TBC |
| MTE1S0312MC | TBC | TBC | TBC | TBC |
| MTE1S0315MC | TBC | TBC | TBC | TBC |
| MTE1S0503MC | TBC | TBC | TBC | TBC |
| MTE1S0505MC | TBC | TBC | TBC | TBC |
| MTE1S0506MC | TBC | TBC | TBC | TBC |
| MTE1S0509MC | TBC | TBC | TBC | TBC |
| MTE1S0512MC | TBC | TBC | TBC | TBC |
| MTE1S0515MC | TBC | TBC | TBC | TBC |
| MTE1S1205MC | TBC | TBC | TBC | TBC |

| | Inductor | | | Capacitor |
|---|---|---|---|---|
| | L, µH | SMD | Through Hole | C, µF |
| MTE1S1209MC | TBC | TBC | TBC | TBC |
| MTE1S1212MC | TBC | TBC | TBC | TBC |
| MTE1S1215MC | TBC | TBC | TBC | TBC |
| MTE1S1505MC | TBC | TBC | TBC | TBC |
| MTE1S1509MC | TBC | TBC | TBC | TBC |
| MTE1S1512MC | TBC | TBC | TBC | TBC |
| MTE1S1515MC | TBC | TBC | TBC | TBC |
| MTE1S2405MC | TBC | TBC | TBC | TBC |
| MTE1S2409MC | TBC | TBC | TBC | TBC |
| MTE1S2412MC | TBC | TBC | TBC | TBC |
| MTE1S2415MC | TBC | TBC | TBC | TBC |

## PACKAGE SPECIFICATIONS

### MECHANICAL DIMENSIONS




All dimensions in mm ±0.25mm (inches ±0.01). All pins on a 2.54 (0.1) pitch and within ± 0.25 (0.01) of true position.

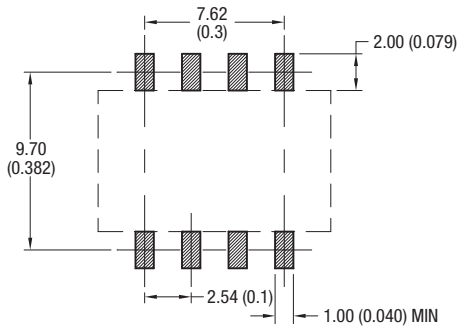
Weight: 1.1g

### PIN CONNECTIONS

| Pin | Function |
|---|---|
| 1 | $-V_{IN}$ |
| 3 | $+V_{IN}$ |
| 7 | $-V_{OUT}$ |
| 8 | $+V_{OUT}$ |
| 14 | NA |

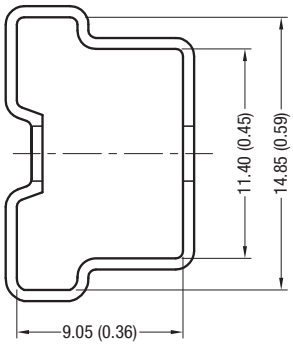
NA - Not available for electrical connection.

### RECOMMENDED FOOTPRINT DETAILS




All pins on a 2.54mm pitch.

### TUBE OUTLINE DIMENSIONS

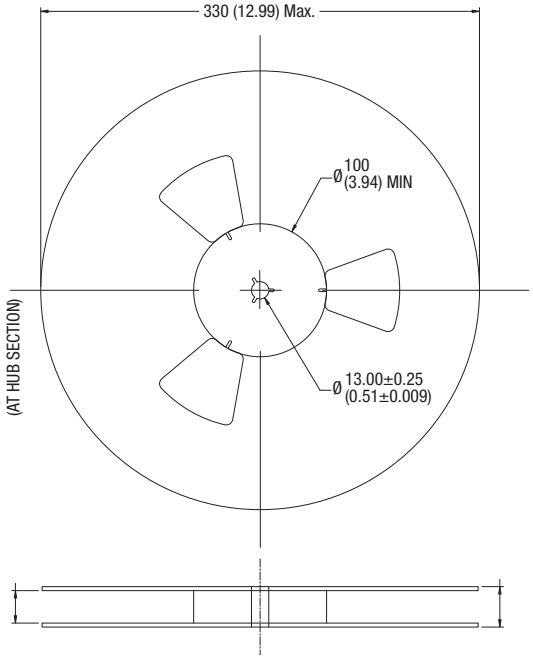



Unless otherwise stated all dimensions in mm±0.5mm (inches ±0.02).
Tube length : 475±2.0 (18.70±0.07).

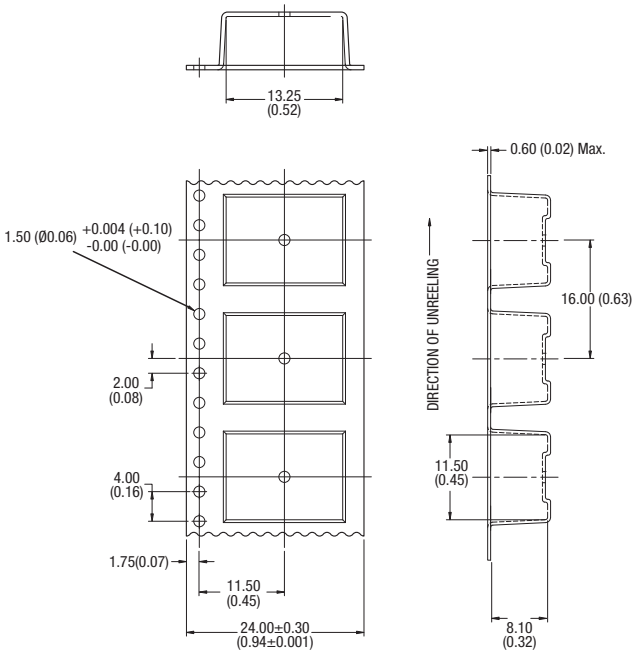
Tube Quantity: 35

## TAPE & REEL SPECIFICATIONS

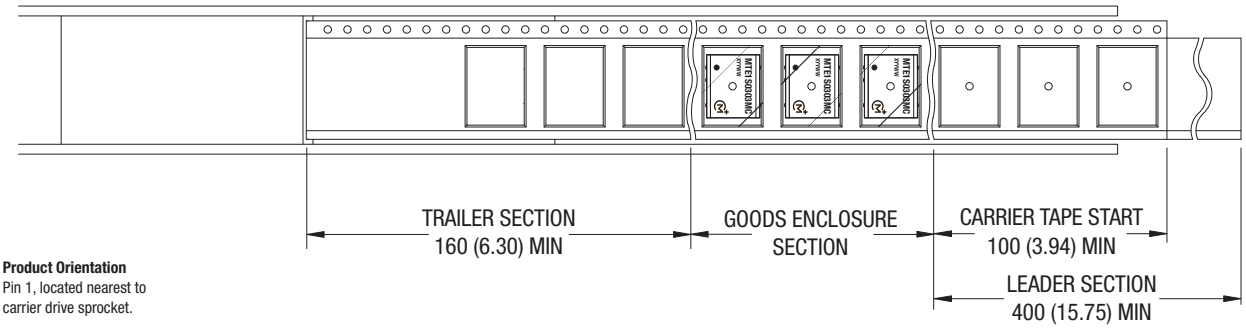
### REEL OUTLINE DIMENSIONS




### TAPE OUTLINE DIMENSIONS




### REEL PACKAGING DETAILS




**Product Orientation**
Pin 1, located nearest to carrier drive sprocket.

Reel Quantity: 500

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