



## FEATURES

- ◆ Footprint over pins 1.37cm<sup>2</sup>
- ◆ Short Circuit Protection(automatic recovery)
- ◆ I/O isolation voltage 1000VDC
- ◆ Operating Temperature: -40℃ ~ + 85℃
- ◆ High efficiency up to 78%
- ◆ Toroidal magnetics
- ◆ Small SMD package with footprint
- ◆ Power density 1.8W/cm<sup>3</sup>
- ◆ Lead frame technology
- ◆ Multi-layer ceramic capacitors
- ◆ Custom solutions available

## MODEL SELECTION

**NTE<sup>①</sup> 05<sup>②</sup> 05<sup>③</sup> XMC<sup>④</sup>**

- ①Product Series    ②Input Voltage  
③Output Voltage    ④Fixed Input&SMD Package

## APPLICATIONS

The NTE-X series are miniature, 1W DC/DC converters with high isolation in a SMD package. With a new package design these converters are qualified for the higher temperatures requested by lead-free reflow solder processes. With the small footprint, these converters are the ideal solution for board level power distribution, mainly for applications in the industrial and telecom field. For automated SMD production lines the devices can be supplied in standard tape and reel package.



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## SELECTION GUIDE

Order code	Input		Output		Efficiency (% Typ.)	Isolation Capacitance pF	MTTF <sup>1</sup> KHrs
	Voltage(VDC)	Current (mA)	Voltage (VDC)	Current (mA)			
	Nominal	Rated Load					
NTE0303XMC	3.3	410	3.3	303	81	29	5348
NTE0305XMC	3.3	390	5	200	83	30	3847
NTE0309XMC	3.3	400	9	111	74	34	3134
NTE0312XMC	3.3	400	12	83	76	40	3473
NTE0315XMC	3.3	400	15	66	81	42	2473
NTE0503XMC	5	270	3.3	303	85	31	5515
NTE0505XMC	5	294	5	200	83	33	6857
NTE0505NXMC	5	260	5	200	86	42	3933
NTE0506XMC	5	278	6	167	83	43	6677
NTE0509XMC	5	267	9	111	85	38	5501
NTE0512XMC	5	260	12	83	74	44	3957
NTE0515XMC	5	256	15	66	78	43	2747
NTE1205XMC	12	124	5	200	80	50	4683
NTE1209XMC	12	114	9	111	80	72	4008
NTE1212XMC	12	113	12	83	85	89	3121
NTE1215XMC	12	111	15	66	81	100	2316

1. Calculated using MIL-HDBK-217FN2 with nominal input voltage at full load.  
All specifications typical at TA=25℃, nominal input voltage and rated output current unless otherwise specified.

## Input Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 3.3V input	2.97	3.3	3.63	VDC
	Continuous operation, 5V input	4.5	5	5.5	VDC
	Continuous operation, 12V input	10.8	12	13.2	VDC
Start up time			30	47	mA p-p

## Isolation Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage	Flash tested for 1 second	1000			VDC
Resistance	Viso= 1000VDC	10			GΩ

## General Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	All output types		110		kHz

## Absolute Maximum Ratings

Parameter	Conditions
Lead temperature 1.5mm from case for 10 seconds	300℃
Internal power dissipation	600mW
Input voltage V, NTE03 types	5.5V
Input voltage Vin, NTE05 types	7V
Input voltage Vin, NTE12 types	15V

### Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	TA=-40°C to 85°C			1.0	W
Voltage Set Point	See tolerance envelope				
Line regulation	High VIN to low VIN		1.0	1.2	%%
Load regulation <sup>1</sup>	10% load to rated load, 0303XMC& 0503XMC		10	14	%
	10% load to rated load, 0505XMC&1205XMC		12.8	15	%
	10% load to rated load, 0506XMC		9.2	10	%
	10% load to rated load, 0509XMC& 1209XMC		8.3	9.0	%
	10% load to rated load, 0512XMC& 1212XMC		6.8	7.5	%
	10% load to rated load, 0515XMC& 1215XMC		6.3	7.0	%
Ripple & Noise	BW=DC to 20MHz, 3.3V output types, 0305XMC & 0505XMC		40	60	mV p-p
	BW=DC to 20MHz, 3.3V output types, 0505XMC & 1205XMC		62	85	mV p-p
	BW=DC to 20MHz, 0506XMC		103	170	mV p-p
	BW=DC to 20MHz, 0509XMC& 1209XMC		49	75	mV p-p
	BW=DC to 20MHz, 0512XMC& 1212XMC		39	65	mV p-p
	BW=DC to 20MHz, 0515XMC& 1215XMC		38	76	mV p-p

Note: 1. 12V input types have typically 3% less load regulation change.

### Temperature Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-55		125	°C
Case temperature rise above ambient	0305, 0309, 0315		25		°C
	0303, 0312, 0503, 0505, 0509, 0512, 0515		30		°C
	0505, 1205		43		°C
	1209, 1212, 1215		40		°C
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.

Professional Power Module NTE-X 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?"

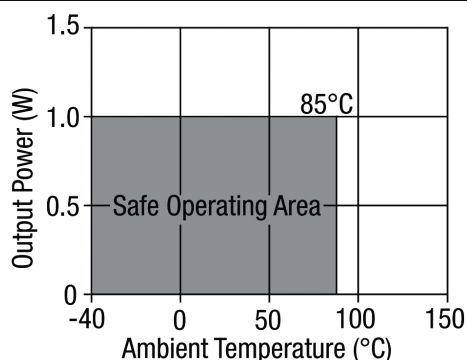
For a part holding no specific agency approvals, such as the NTE-X series, both input and output should normally be maintained within SELV limits i.e. less than 42.4V peak, or 60VDC. The isolation test voltage represents a measure of immunity to transient voltages and the part should never be used as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



### Application Notes

#### Minimum load

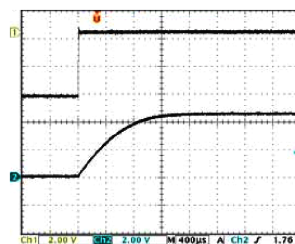
The minimum load to meet data sheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than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

#### Capacitive loading and start up

Typical start up times for this series, with a typical input voltage rise time of 2.2  $\mu$ s and output capacitance of 10  $\mu$ F, are shown in the table below. The product series will start into a capacitance of 47  $\mu$ F with an increased start time, however, the maximum recommended output capacitance is 10  $\mu$ F.

Start-up time		Start-up time	
$\mu$ s		$\mu$ s	
NTE0303XMC	437	NTE0506XMC	7200
NTE0305XMC	1359	NTE0509XMC	3146
NTE0309XMC	3435	NTE0512XMC	4960
NTE0312XMC	6590	NTE0515XMC	7740
NTE0315XMC	7625	NTE1205XMC	895
NTE0503XMC	533	NTE1209XMC	2150
NTE0505XMC	1368	NTE1212XMC	3640
NTE0505NXMC	721	NTE1215XMC	7180

Typical Start-Up Wave Form



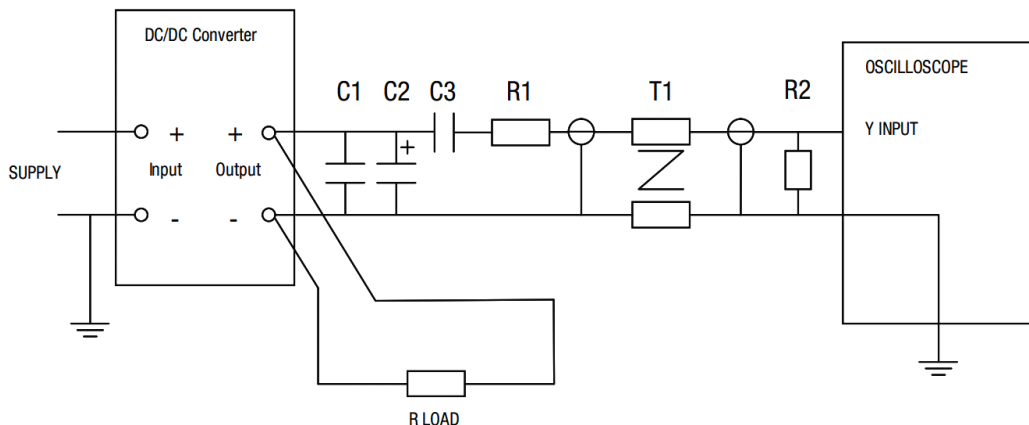
#### Ripple & Noise Characterization Method

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

#### Output Ripple Reduction

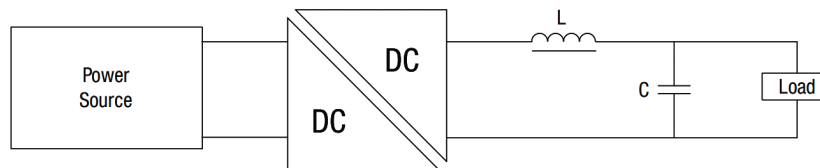
By using the values of inductance and capacitance stated, the output ripple at the rated load is lowered to 5mV p-p max.

##### 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.

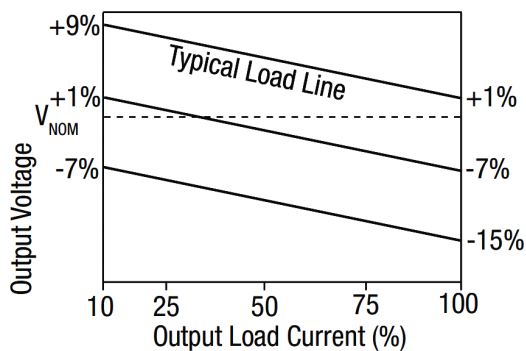
**Inductor:** The rated current of the inductor should not be less than that of the output of the DC/DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC/DC converter. The SRF (Self Resonant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



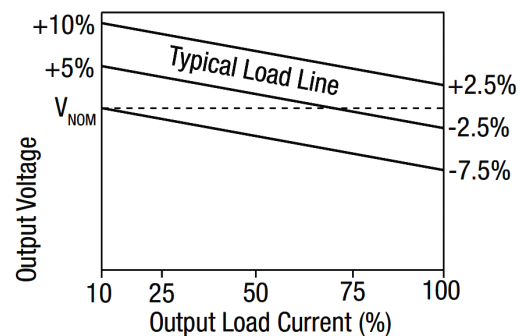
	Inductor			Capacitor
	L, $\mu$ H	SMD	Through Hole	C, $\mu$ F
NTE0303XMC	10	82103C	11R103C	4.7
NTE0305XMC	47	82473C	11R103C	4.7
NTE0309XMC	22	82223C	11R223C	2.2
NTE0312XMC	10	82103C	11R103C	1
NTE0315XMC	47	82473C	11R473C	1
NTE0503XMC	10	82103C	11R103C	4.7
NTE0505XMC	47	82473C	11R473C	4.7
NTE0505NXMC	47	82473C	11R473C	4.7
NTE0506XMC	10	82103C	11R103C	4.7
NTE0509XMC	22	82223C	11R223C	2.2
NTE0512XMC	47	82473C	11R473C	1
NTE0515XMC	47	82473C	11R473C	1
NTE1205XMC	47	82473C	11R473C	4.7
NTE1209XMC	22	82223C	11R223C	2.2
NTE1212XMC	47	82473C	11R473C	1
NTE1215XMC	47	82473C	11R473C	1

### Tolerance Envelopes

Tolerance Envelope - 3.3V output types.



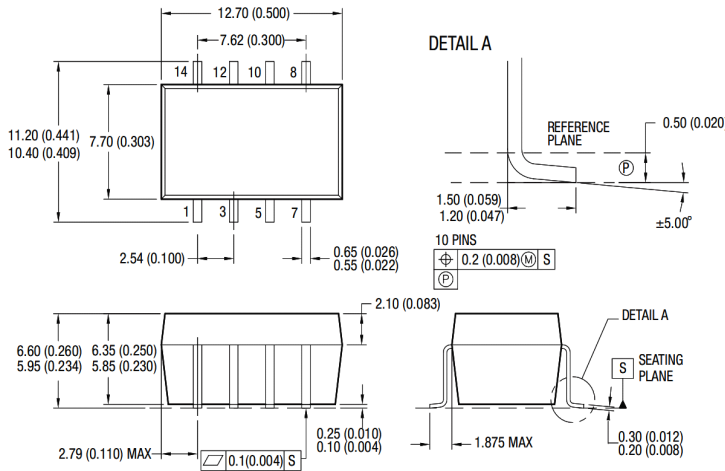
All other types.



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.

### OUTLINE DIMENSIONS & FOOTPRINT DETAILS

#### MECHANICAL DIMENSIONS



Note:  
Unit:mm[inch]  
Pin section tolerances:±0.10mm[±0.004inch]  
General tolerances:±0.25mm[±0.010inch]

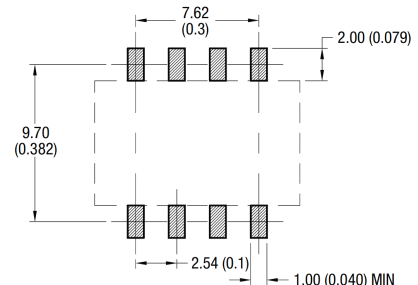
Weight: 1.21g

#### FOOTPRINT DETAILS

Pin	Single
1	-Vin
3	+Vin
5	NA
7	-Vout
8	+Vout
10	NA
12	NA
14	NA

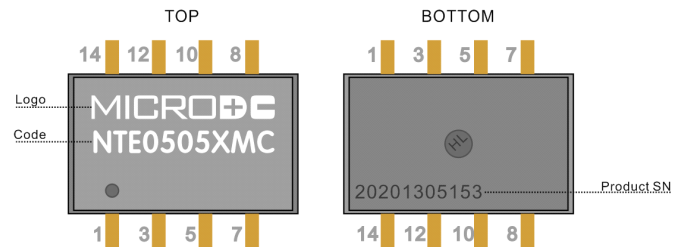
NA - Not available for electrical connection.

#### SOLDER PAD DIMENSION

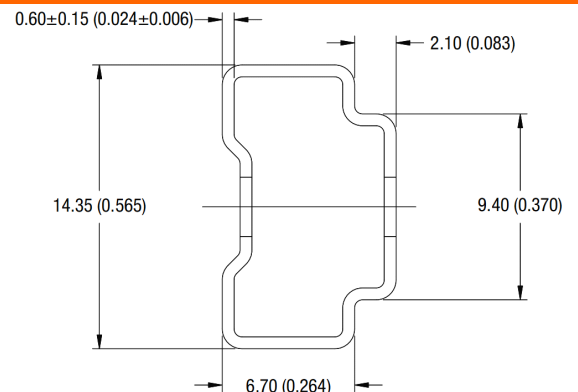


Dimensions in [mm], ( ) = Inch  
Pin pitch tolerances: ±0.13 (±0.005)  
Other tolerances: ±0.25 (±0.01)

#### PRODUCT ID DESCRIPTION



#### TUBE OUTLINE DIMENSIONS



Unless otherwise stated all dimensions in mm±0.5 (inches ±0.02).  
Tube length : 475±2.0 (18.70±0.07). Tube Quantity :35

**Specifications can be changed any time without notice.**

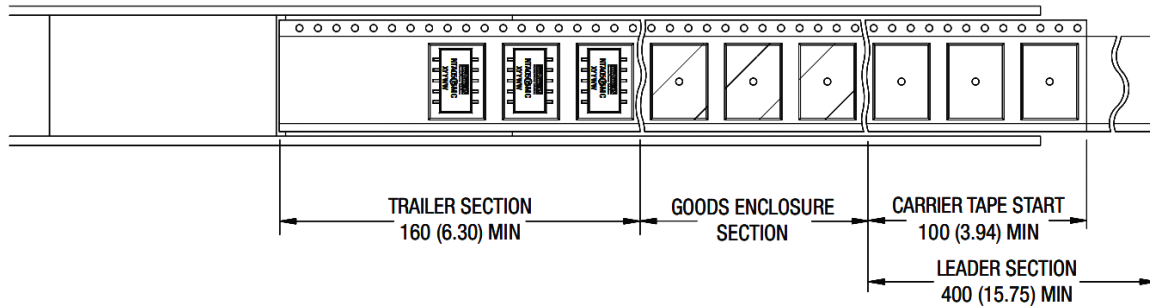
**No parallel connection or plug and play.**

Note:

1. The load shouldn't be less than 10%, otherwise ripple will increase dramatically.
2. Operation under 10% load will not damage the converter; However, they may not meet all specification listed.
3. All specifications measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.
4. In this data sheet, all the test methods of indications are based on corporate standards.
5. Only typical models listed, other models may be different, please contact our technical person for more details.

### Tape & Reel Specifications

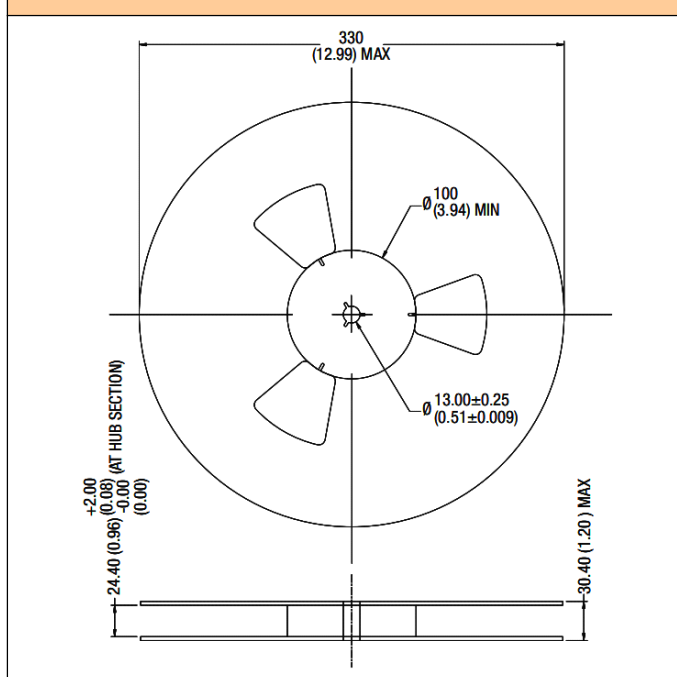
#### Reel Packaging Details



#### Product Orientation

Pin 1, located nearest to carrier drive sprocket.  
Reel Quantity : 500

#### Reel Outline Dimensions



#### Tape Outline Dimensions

