INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 5V input types	4.5	5	5.5	V
	Continuous operation, 12V input types	10.8	12	13.2	
	Continuous operation, 15V input types	13.5	15	16.5	
	Continuous operation, 24V input types	21.6	24	26.4	
Reflected ripple current	NMK0505TSAC		5		mA p-p
	NMK2405SAC, NMK2409SAC, NMK2405SC, NMK2409SC		14	25	
	All other variants		7.5	15	

OUTPUT CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 105°C				2	W
Voltage Set Point Accuracy	See tolerance envelope					
Line regulation	High V_{IN} to low V_{IN}	NMK0505TSAC		1.1	1.2	%/%
		All other variants		1.05	1.2	

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation test voltage	Flash tested for 1 minute	3000			VDC
Resistance	Viso= 1000VDC	10			GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	NMK0505TSAC		50		kHz
	All other variants		60		

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	NMK0505TSAC	-40		105	°C
	All other output types, see safety approval section for UL temperature specification	-40		85	
Storage		-50		125	
Case Temperature above ambient	NMK0505TSAC		22		
	5V output types & NMK1509SAC (Except NMK1505S(A)C & NMK2405S(A)			28	
	NMK1505S(A)C & NMK2405S(A)C			32	
	All other output types			25	
Cooling	Free air convection				

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	260°C
Wave Solder	Wave Solder profile not to exceed the profile recommended in IEC 61760-1 Section 6.1.3. Please refer to application notes for further information.
Input voltage V_{IN}, NMK05 types	7V
Input voltage V_{IN}, NMK12 types	15V
Input voltage V_{IN}, NMK15 types	18V
Input voltage V_{IN}, NMK24 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 NMK series of DC-DC converters are all 100% production tested at their stated isolation voltage. This is 3kVDC for 1 minute.

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

The NMK series has been recognised by Underwriters Laboratory for functional insulation. 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 NMK series has toroidal isolation transformers, with no additional insulation between primary and secondary windings of enamelled 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 recognised 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.

SAFETY APPROVAL

The NMK series has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum ambient temperature of 85ºC and/or case temperature limit of 130ºC. Case temperature measured on the face opposite the pins. File number E151252 applies. The NMK0505TSAC is pending recognition to UL62368-1.

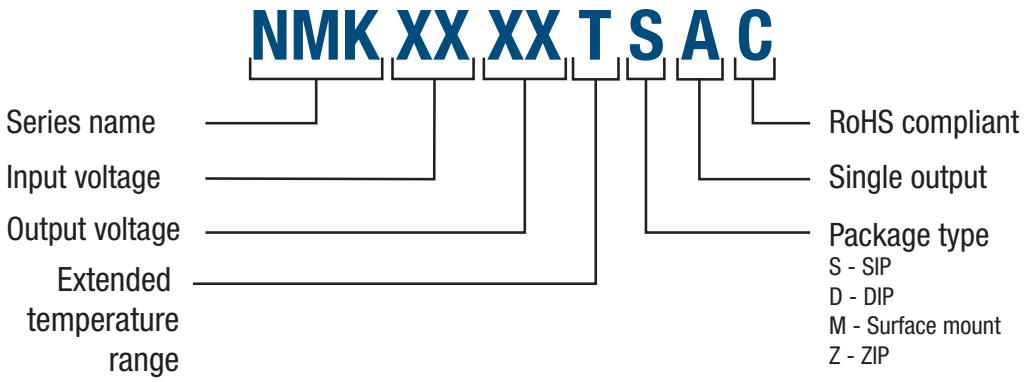
The NMK Series of converters are not internally fused so to meet the requirements of UL 60950 an anti-surge input line fuse should always be used as below:
NMK05xxSC/SAC: 2A
NMK12xxSC/SAC: 0.75A
NMK15xxSC/SAC: 0.75A
NMK24xxSC/SAC: 0.375A

RoHS COMPLIANT INFORMATION

RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds. Please refer to application notes for further information. The pin termination finish on the SIP package type is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The DIP types are Matte Tin over Nickel Preplate. Both types in this series are backward compatible with Sn/Pb soldering systems. For further information, please visit www.murata-ps.com/rohs

PART NUMBER STRUCTURE



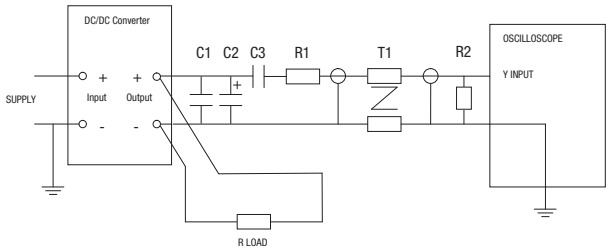
CHARACTERISATION TEST METHODS

Ripple & Noise Characterisation Method

All measurement to be taken with the following components connected to the UUT as detailed below. 50 Ohm coax cable, solder connections one end, BNC plug at the other end.

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 rated at minimum 1.5 x the output voltage of the UUT with ESR of less than 100 milliohms at 100 kHz e.g. AVX TPS series.
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%.

Unbalanced Load

The NMK series offers unbalanced loading capabilities with up to the full 2W available from a single output. However, when operated in this mode there may be a slight performance decrease in efficiency and load regulation.

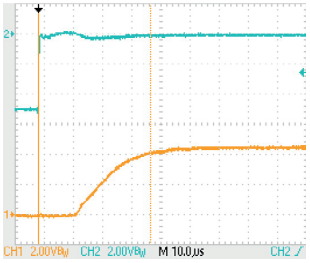
Capacitive loading and start up

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
NMK0505TSAC	110
NMK05XXSAC	
NMK12XXSAC	
NMK15XXSAC	
NMK24XXSAC	
NMK05XXSC	
NMK12XXSC	

	Start-up time
	µs
NMK15XXSC	
NMK24XXSC	

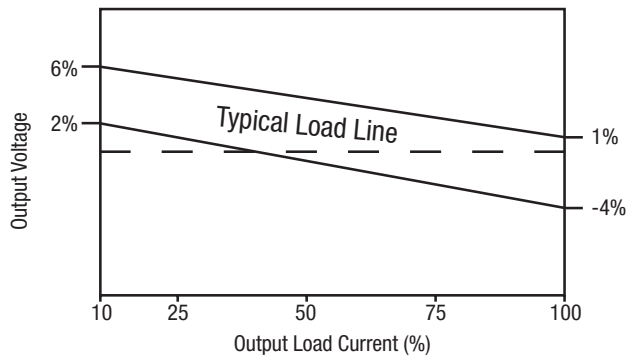
Typical Start-Up Wave Form



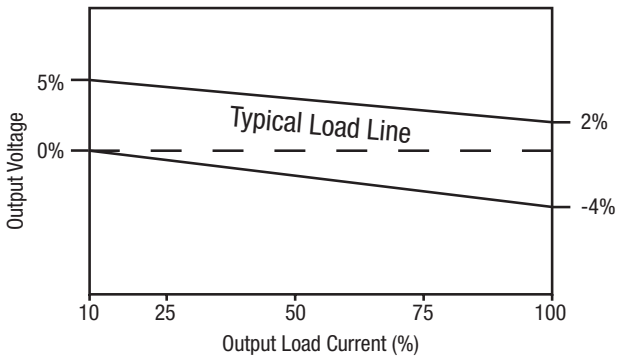
TOLERANCE ENVELOPES

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.

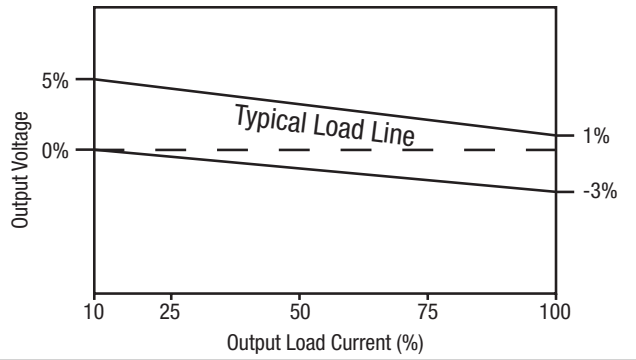
NMK0505TSAC



NMKXXXXSAC

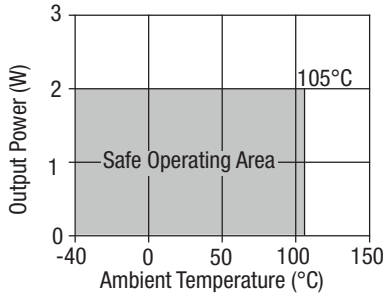


NMKXXXXSC

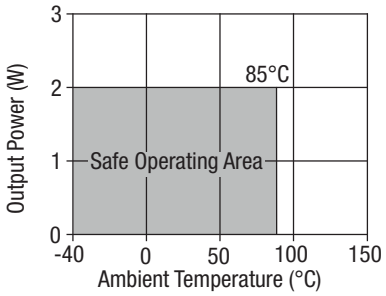


TEMPERATURE DERATING GRAPH

NMK0505TSAC:

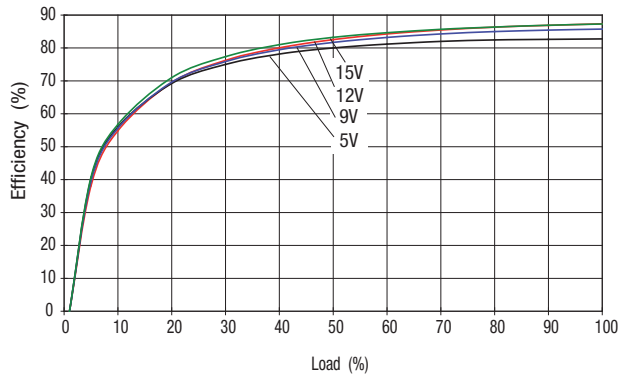


All other variants:

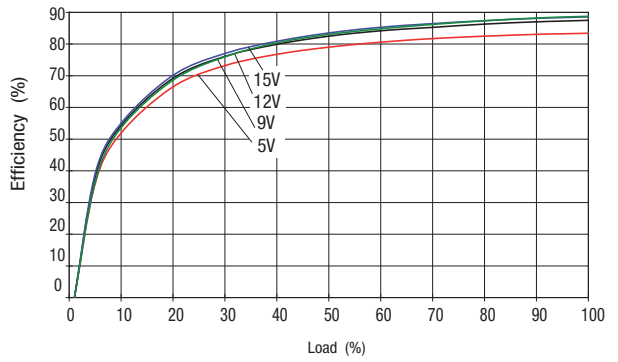


EFFICIENCY VS LOAD

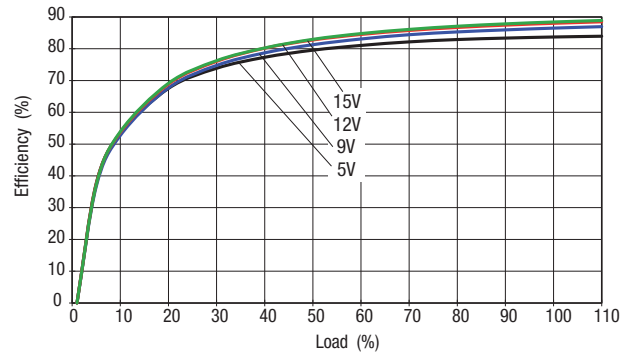
NMK05XXSAC



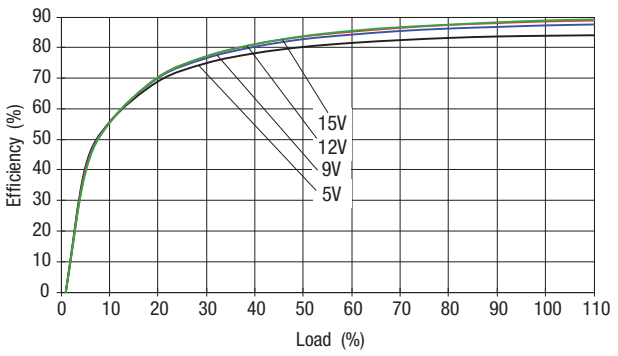
NMK12XXSAC



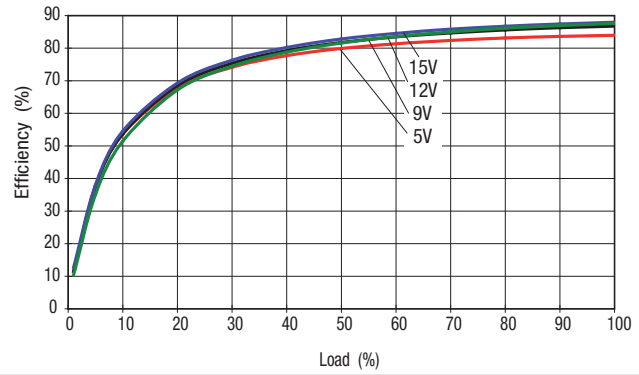
NMK15XXSAC



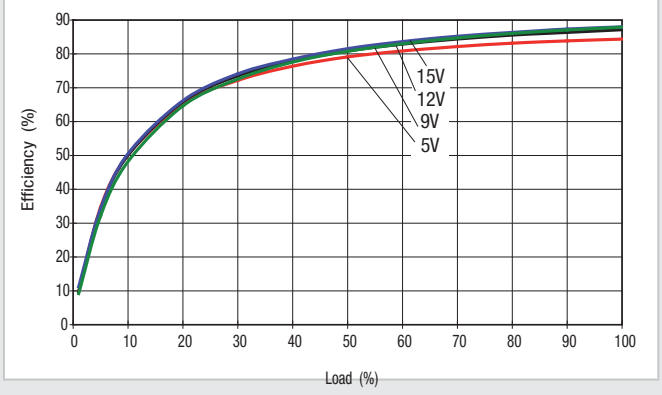
NMK24XXSAC



NMK05XXSC

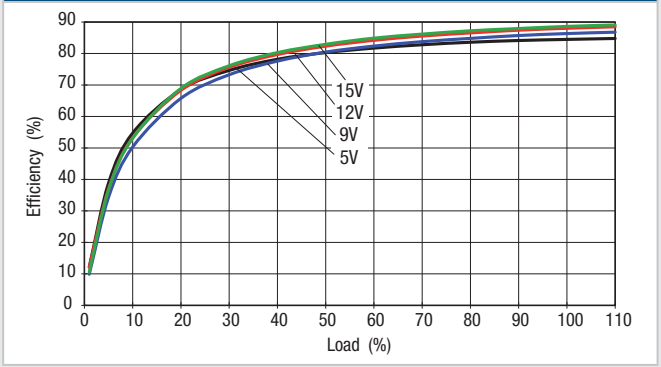


NMK12XXSC

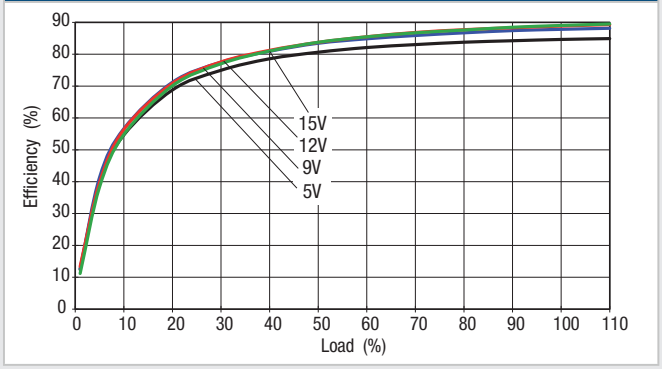


EFFICIENCY VS LOAD (Continued)

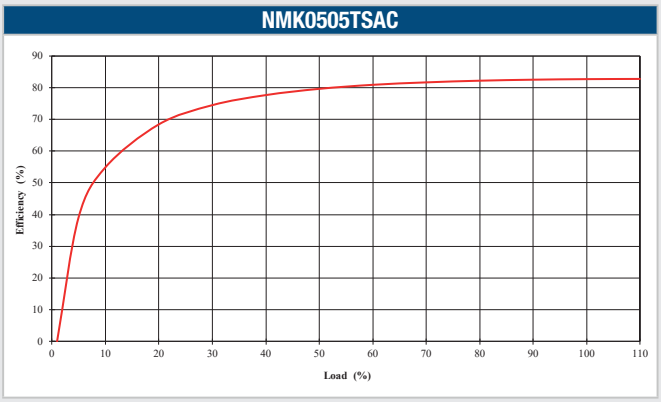
NMK15XXSC



NMK24XXSC



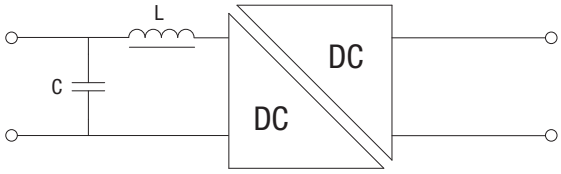
NMK0505TSAC



EMC FILTERING AND SPECTRA

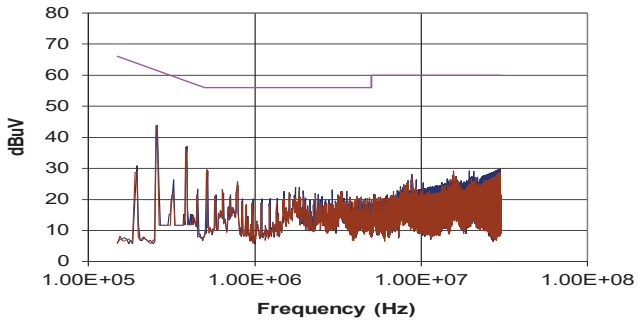
FILTERING

The following filter circuit and filter table shows the input filters typically required to meet conducted emissions limits for EN 55022 curve B using Quasi-Peak and average detectors according to CISPR 22.

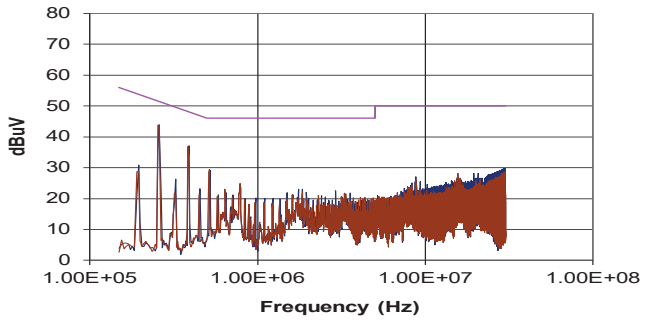


	Inductor		Capacitor	
Part Number	L, µH	SMD	C, µF	SMD
NMK0505TSAC	10µH	23100C	2.2µF	GRM188C71E225KE11D

NMK0505TSAC (Quasi-Peak)

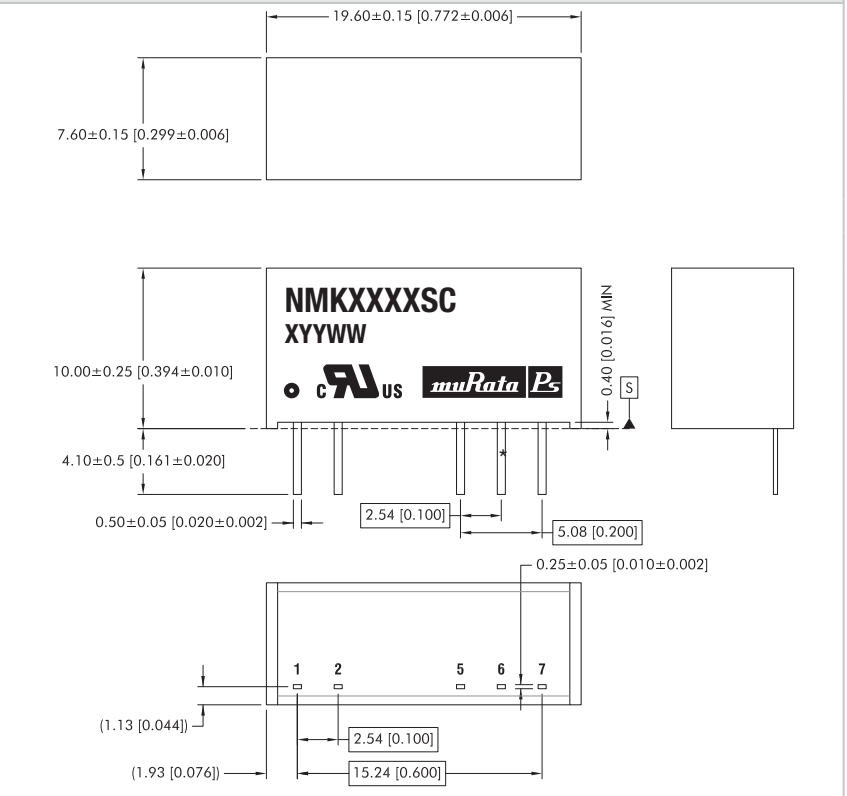


NMK0505TSAC (Average)



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



* Pin not fitted on single output variants.

All dimensions in mm (inches) Controlling dimension is mm.

All pins on a 2.54 (0.100) pitch and within ±0. I (0.004) of true position from pin I at seating plane 'S'

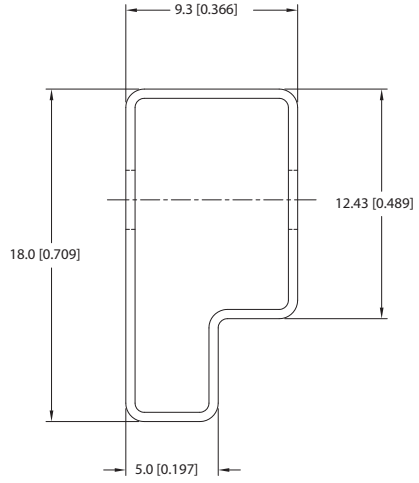
Weight: 2.8g

PIN CONNECTIONS

Single output variants	
Pin	Function
1	+V_{IN}
2	-V_{IN}
5	-V_{OUT}
7	+V_{OUT}

Dual output variants	
Pin	Function
1	+V_{IN}
2	-V_{IN}
5	-V_{OUT}
6	0V
7	+V_{OUT}

TUBE OUTLINE DIMENSIONS

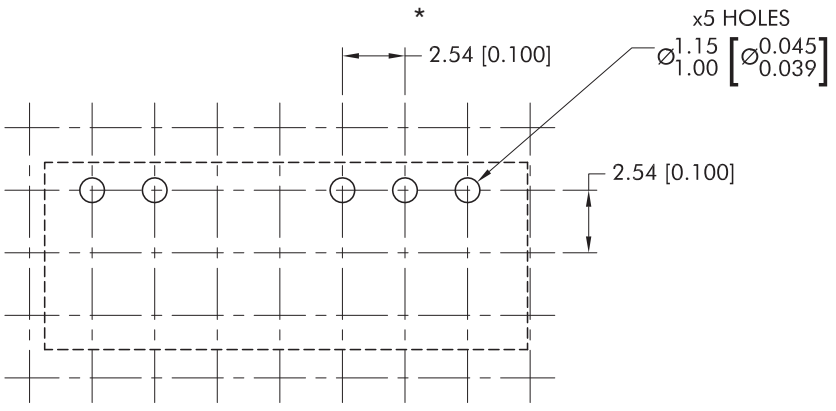


Unless otherwise stated all dimensions in mm (inches) ±0.5mm.

Tube length : 520mm ±2mm (20.47).

Tube Quantity : 25

RECOMMENDED FOOTPRINT DETAILS



* Hole not required for single output variants.

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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.

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- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Data Processing equipment

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