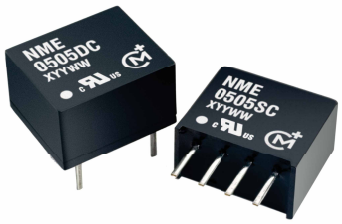
NME Series

Isolated 1W Single Output DC/DC Converters



FEATURES

- Short circuit protection options
- UL 60950 recognised
- Single isolated output
- 1kVDC isolation 'Hi Pot Test'
- Wide temperature performance at full 1 watt load, –40°C to 85°C[2]
- Industry standard pinout
- 5V, 12V, 15V & 24V input
- 5V, 9V, 12V and 15V output
- Fully encapsulated with toroidal magnetics
- No external components required
- Pin compatible with CME, CRE1, CRL2, LME, MEE1, MEE3, NKE & NML

DESCRIPTION

The NME series of DC/DC Converters is particularly suited to isolating and/or converting DC power rails. The galvanic isolation allows the device to be configured to provide an isolated negative rail in systems where only positive rails exist. The wide temperature range guarantees startup from –40°C and full 1 watt output at 85°C[2]. For lower ripple, refer to output ripple reduction section. The NME series offers short circuit protection options (PC) across the operating temperature range. Short circuits of less than 1Ω cause the converter to enter a 'foldback' limiting mode such that the input current is approximately 95mA for 0505 variant. Protection is continuous and auto-resetting on removal of the short circuit.

SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Load Regulation[2]		Ripple & Noise		Efficiency (Min)	Efficiency (Typ)	Isolation Capacitance	MTTF[1]		Package Style
	V	V	mA	mA	% Typ.	% Max.	mV p-p Typ.	mV p-p Max.	%	%	pF	MIL. kHrs	Tel. kHrs	
Recommended **In Production**														
NME0505DC	5	5	200	286	12	14	16	40		69	30	3415		DIP
NME0509DC	5	9	111	260	8	9	60	75		77	37	3078		
NME0512DC	5	12	83	256	6.5	7.5	50	65		78	33	2205		
NME0515DC	5	15	67	250	6	7.5	10	25		80	40	1532		
NME0524DC	5	24	42	248	5.5	7.5	140	180		80	48			
NME0505SC	5	5	200	286	12	14	16	40		69	30	3415		SIP
NME0509SC	5	9	111	260	8	9	60	75		77	37	3078		
NME0512SC	5	12	83	256	6.5	7.5	50	65		78	33	2205		
NME0515SC	5	15	67	250	6	7.5	10	25		80	40	1532		
NME0524SC	5	24	42	248	5.5	7.5	140	180		80	48			
NME1205DC	12	5	200	117	8	10	12	30		69	33	2493		DIP
NME1212DC	12	12	83	104	4	5	8	20		76	55	1780		
NME1215DC	12	15	67	110	3	4	40	55		75	52	1313		
NME1205SC	12	5	200	117	8	10	12	30		69	33	2493		SIP
NME1209SC	12	9	111	115	5	5.5	60	75		74	48	2311		
NME1212SC	12	12	83	104	4	5	50	65		76	55	1780		
NME1215SC	12	15	67	111	3	4	40	55		75	52	1313		
NME1515SC	15	15	67	81	2.5	3		150		82				
NME2405DC	24	5	200	58	8.5	10		150		70	40	201		DIP
NME2412DC	24	12	83	52	3	4		150		80	78	163		
NME2415DC	24	15	67	51	2.5	3		150		80	79	136		
NME2405SC	24	5	200	58	8.5	10		150		70	40	201		SIP
NME2412SC	24	12	83	52	3	4		150		80	78	163		
NME2415SC	24	15	67	51	2.5	3		150		80	79	136		
Short Circuit Protection Options														
NME0505SPC	5	5	200	255	9.5	12	11	25	75	77	22	2887	47047	SIP
NME0505DPC	5	5	200	255	9.5	12	11	25	75	77	22	2887	47047	DIP
To Be Discontinued														**Recommended Alternative**
NME1209DC	12	9	111	115	5	5.5	60	75		74	48	2311		DIP MEE1S1209DC
NME2409DC	24	9	111	54	4	5		150		75	59	185		DIP MEE1S2409DC
NME2409SC	24	9	111	54	4	5		150		75	59	185		SIP MEE1S2409SC

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	12.0	13.2	
	Continuous operation, 15V input types	13.5	15	16.5	
	Continuous operation, 24V input types	21.6	24	26.4	
Input short circuit current	Short circuit variants		95		mA
Input Reflected ripple current	Short circuit variants		3	15	mA p-p
	15V input type			90	
	All other variants[3]		26	48	

1. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
2. NME1515SC, NME24XXXC prior to date code X1635 have operating temperature range of 0 to 70°C .
3. Excludes 24V input types.

All specifications typical at T_A=25°C, nominal input voltage and rated output current unless otherwise specified.

RoHS COMPLIANT

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

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	See derating curves			1.0	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN} ; All short circuit types		1.15	1.2	%/%
	High V_{IN} to low V_{IN} ; All other output types		1.0	1.2	

ISOLATION CHARACTERISTICS

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

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	5V input types		110		kHz
	12V input types		145		
	15V input types		100		
	24V input types		100		
	Short circuit types		91		

TEMPERATURE CHARACTERISTICS

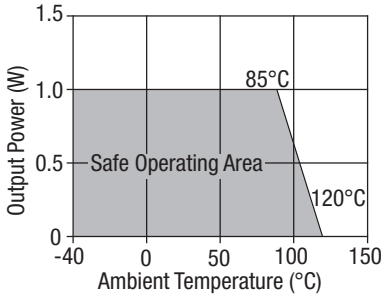
Parameter	Conditions		Min.	Typ.	Max.	Units
Specification	All output types[1]		-40		85	°C
Storage			-50		130	
Case Temperature above ambient	Non-short circuit types	5V output types			41	
		All other output types[2]			32	
	Short circuit types (DIP)			23		
	Short circuit types (SIP)			24		
Cooling	Free air convection					

ABSOLUTE MAXIMUM RATINGS

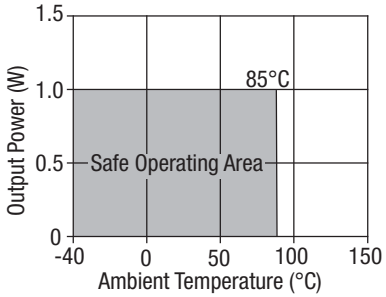
Lead temperature 1.5mm from case for 10 seconds	260°C
Input voltage V_{IN}, NME05 types	7V
Input voltage V_{IN}, NME12 types	15V
Input voltage V_{IN}, NME15 types	18V
Input voltage V_{IN}, NME24 types	28V

TEMPERATURE DERATING GRAPH

Non-short circuit types[1]:



Short circuit types:

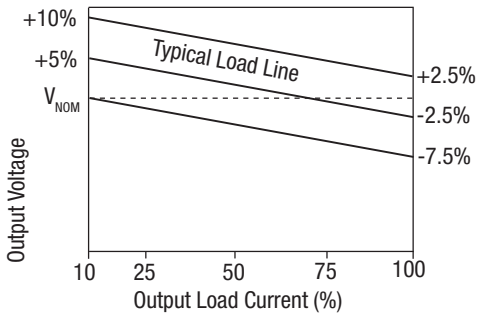


1. NME1515SC, NME24XXXC prior to date code X1635 have operating temperature range of 0 to 70°C .
2. Excludes 24V input types.

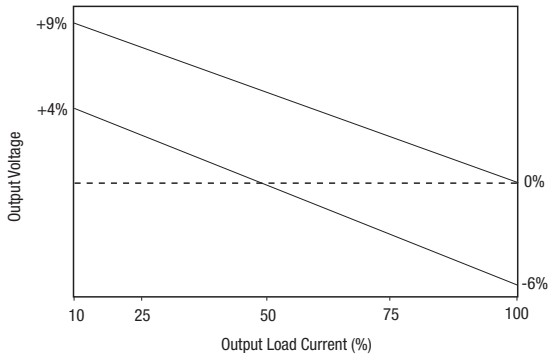
TOLERANCE ENVELOPES

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.

5V, 12V, 15V & 24V Input types



Short circuit



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 NME 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?"

The NME 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 NME 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.

SAFETY APPROVAL

The NME 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 100ºC. Case temperature measured on the face opposite the pins.

The NME 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 with ratings as defined below.
NME05xxxxC: 0.5A
NME12xxxxC: 0.25A
NME15xxxxC: 0.2A
NME24xxxxC: 0.12A

All fuses should be UL recognised and rated at 125V.

File number E151252 applies.

RoHS COMPLIANCE INFORMATION

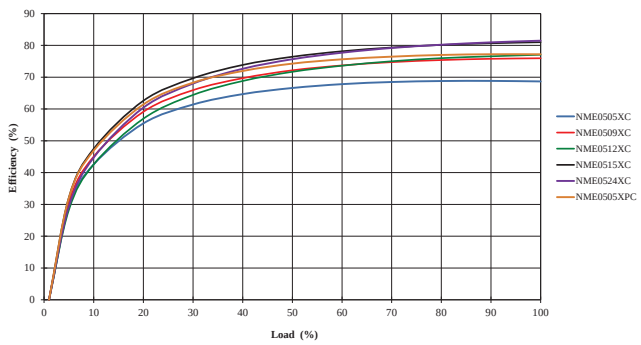
RoHS COMPLIANT

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds. 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.

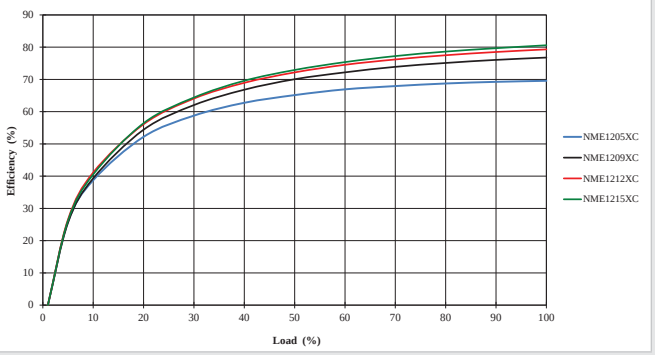
For further information, please visit www.murata-ps.com/rohs

EFFICIENCY VS LOAD

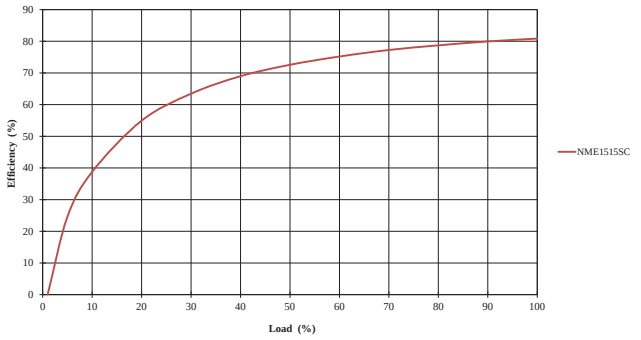
5V & Short circuit input variants



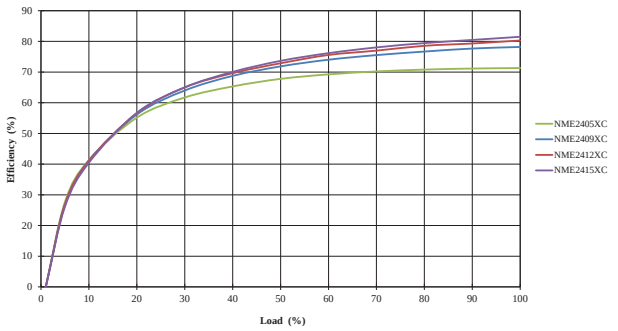
12V Inputs



15V Inputs



24V Inputs



APPLICATION NOTES

Minimum load

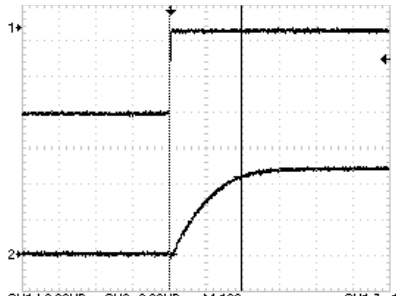
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

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
NME0505XC	991
NME0509XC	3524
NME0512XC	5630
NME0515XC	7750
NME0524XC	19850
NME1205XC	682
NME1209XC	2102
NME1212XC	4030
NME1215XC	6193
NME1515SC	685
NME2405XC	135
NME2409XC	260
NME2412XC	430
NME2415XC	640
NME0505XPC	350

Typical Start-Up Wave Form

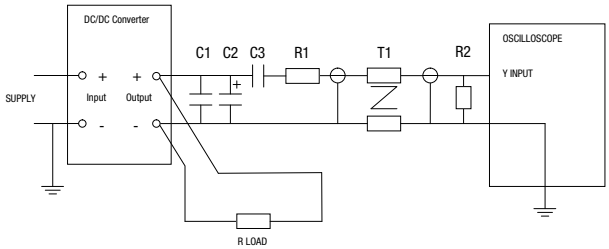


Ripple & Noise Characterisation Method

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

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, voltage rating to be a minimum of 1.5 times the output voltage of the DC/DC converter with an ESR of less than 100mΩ at 100 kHz
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 (continued)

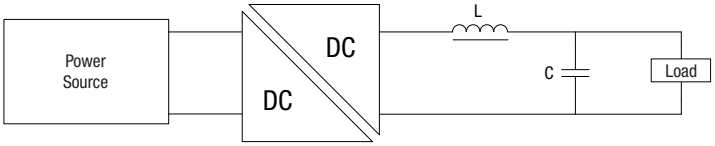
Output Ripple Reduction

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.

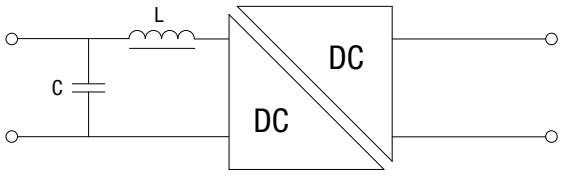


	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
NME0505XC	47	82473C	11R473C	4.7uF
NME0509XC	47	82473C	11R473C	1uF
NME0512XC	68	82683C	11R683C	1uF
NME0515XC	100	82104C	11R104C	0.47uF
NME0524XC	100	82104C	11R104C	0.47
NME1205XC	100	82104C	11R104C	4.7uF
NME1209XC	47	82473C	11R473C	1uF
NME1212XC	68	82683C	11R683C	0.47uF
NME1215XC	100	82104C	11R104C	0.47uF
NME1515SC				
NME2405XC				
NME2409XC				
NME2412XC				
NME2415XC				
NME0505XPC	22	82223C	11R223C	1uF

EMC FILTERING AND SPECTRA

FILTERING

The following table shows the additional input capacitor and input inductor typically required to meet EN 55022 Curve B Quasi-Peak EMC limit, as shown in the following plots. The following plots show positive and negative quasi peak and CISPR22 Average Limit B (pink line) and Quasi Peak Limit B (green line) adherence limits.



C Ceramic capacitor

	Inductor			Capacitor
Part Number	L, µH	SMD	Through Hole	C, µF
NME0505XC	4.7		13R472C	4.7
NME0509XC				
NME0512XC				
NME0515XC	4.7		13R472C	4.7
NME0524XC				
NME1205XC	10		13R103C	1
NME1209XC				
NME1212XC	10		13R103C	1

	Inductor			Capacitor
Part Number	L, µH	SMD	Through Hole	C, µF
NME1215XC				
NME1515SC				
NME2405XC	22		13R223C	10
NME2409XC				
NME2412XC	22		13R223C	10
NME2415XC				
NME0505XPC	10	82103C	13R103C	1

NME0505XC

NME0509XC

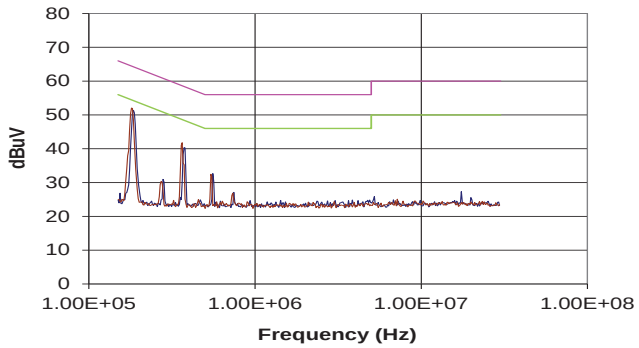
NME0512XC

NME0515XC

EMC FILTERING AND SPECTRA

NME0524XC

NME0505XPC



NME1205XC

NME1209XC

NME1212XC

NME1215XC

EMC FILTERING AND SPECTRA

NME1515SC

NME2405XC

NME2409XC

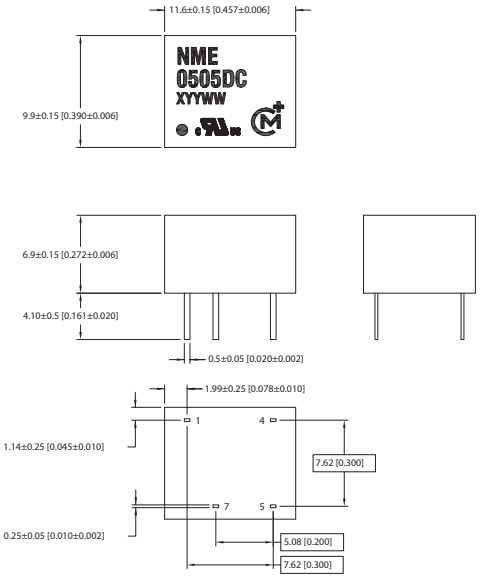
NME2412XC

NME2415XC

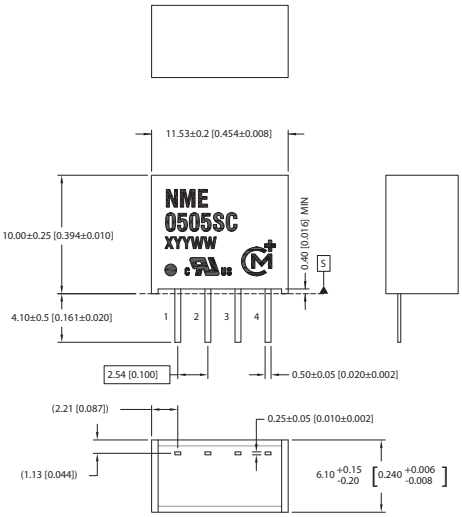
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

DIP Package



SIP Package



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

All pins on a 2.54 (0.100) pitch and within ±0.1 (0.004) of true position from pin 1 at seating plane 'S'

Weight: 1.30g (SIP) 1.48g (DIP) 1.5g (SP DIP)

PIN CONNECTIONS - 8 PIN DIP

Pin	Function
1	-V_{IN}
4	+V_{IN}
5	+V_{OUT}
7	-V_{OUT}

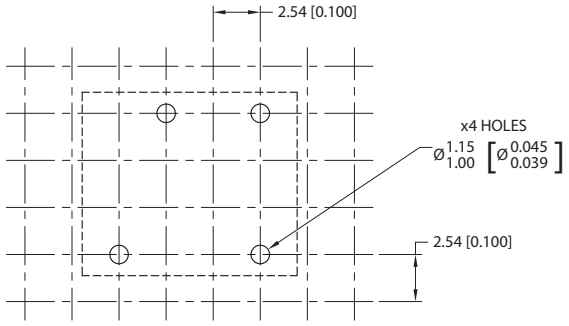
PIN CONNECTIONS - 4 PIN SIP

Pin	Function
1	-V_{IN}
2	+V_{IN}
3	-V_{OUT}
4	+V_{OUT}

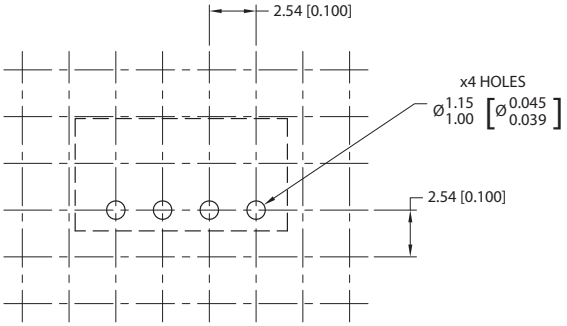
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

8 Pin DIP Package

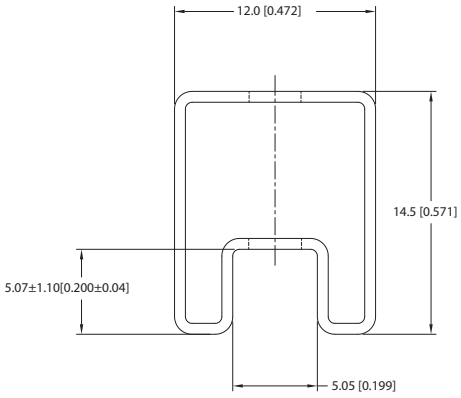


4 Pin SIP Package

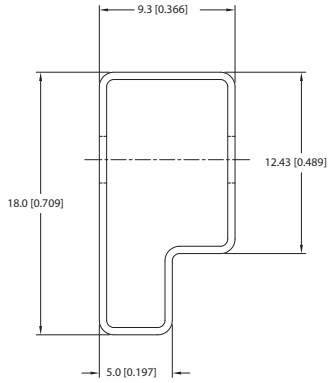


TUBE OUTLINE DIMENSIONS

8 Pin DIP Tube



4 Pin SIP Tube



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].
Tube Length (8 Pin DIP) : 520mm [20.472] ±2.0 [0.079].
Tube Length (4 Pin SIP) : 520mm [20.472] ±2.0 [0.079].

Tube Quantity : 35