Murata Power Solutions

MMV1 Series

3kVDC Isolated 1W Single Output DC-DC Converters with Short Circuit Protection

FEATURES

- Short circuit protection
- Efficiency from 78% typical
- Wide temperature performance at full 1 Watt load, –40°C to 85°C
- UL 94V-0 package material
- 3kVDC isolation (1 minute) 'Hi Pot Test'
- Internal SMD construction
- Fully encapsulated with toroidal magnetics
- No external components required
- No electrolytic or tantalum capacitors
- Patent pending
- UL60950 recognised
- Operation to zero load

PRODUCT OVERVIEW

The MMV1S series of DC-DC converters are a high efficiency version of the popular NMV series but with guaranteed short circuit protection across the operating temperature range. Short circuits of less than 1Ω cause the converter to enter a 'foldback' limiting mode such that the the input current is approximately 100mA for 0505 variant and 45mA for 0524 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 (Typ)	Load Regulation (Max)	Ripple & Noise (Typ)	Ripple & Noise (Max)	Efficiency (Min.)	Efficiency (Typ.)	Isolation Capacitance	MTTF[1]
	V	V	mA	mA	%		mVp-p		%		pF	kHrs
MMV1S0505SC	5	5	200	250	9	11	20	40	75	78	20	2680
MMV1S0524SC	5	24	41.7	245	4.5	6	15	20	79	81	36	3432

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation	4.5	5	5.5	V
Input short circuit current I_{SC}	5V output types		100		mA
	24V output types		45		
Reflected ripple current			5	15	mA p-p

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 85°C			1	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN}		1.1	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			88		kHz

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating	All output types, see safety approval section for UL temperature specification	-40		85	°C
Storage		-50		125	
Case Temperature rise above ambient				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}	7V

ROHS COMPLIANT

For full details go to https://www.murata.com/en-global/products/power/rohs

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1. 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.

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 MMV1 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 MMV1 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 MMV1 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 MMV1 has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum still air ambient temperature of 85°C and/or case temperature limit of 155ºC (case temperature measured on the face opposite the pins).

The MMV1 converter is 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.

MMV1S0505SC: 0.375A
MMV1S0524SC: 0.4A

The fuses should be UL recognised and rated to at least the maximum allowable DC input voltage.

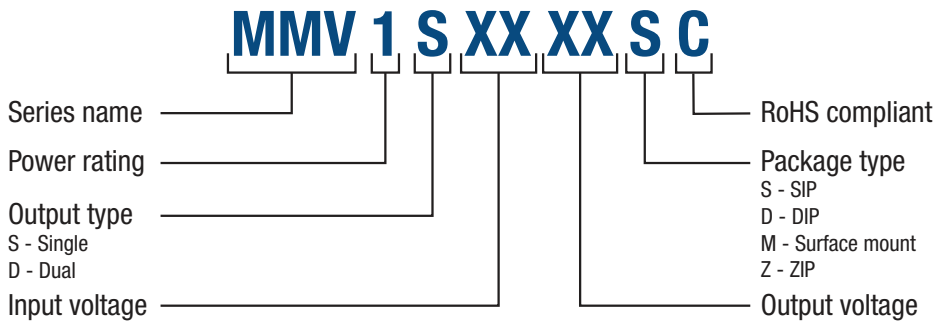
File number E151252 applies.

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. Please refer to application notes for further information. The pin termination finish is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The MMV1 series is backward compatible with Sn/Pb soldering systems.
For further information, please visit www.murata-ps.com/rohs

PART NUMBER STRUCTURE



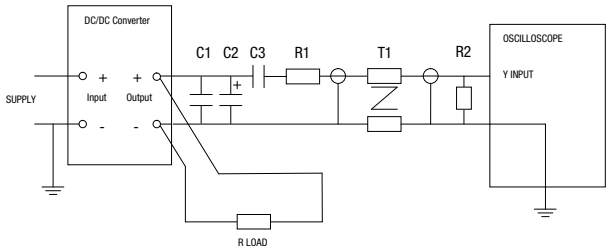
CHARACTERISATION TEST METHODS

Ripple & Noise Characterisation Method

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

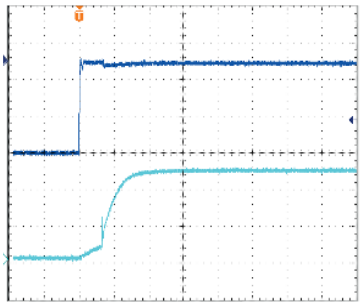
Minimum load

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 1.25 times the specified output voltage if the output load falls to less than 5%.

Capacitive loading and start up

Typical start up time for the MMV1 series, with a typical input voltage rise time of 2.2µs and output capacitance of 10µF is 370µS for 0505 variant and 5.8mS for 0524 variant. The product series will start into a capacitance of 47µF with an increased start time, however, the maximum recommended output capacitance is 10µF.

Typical Start-Up Wave Form



APPLICATION NOTES (Continued)

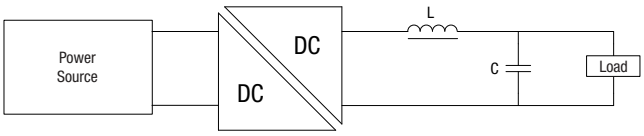
Output Ripple Reduction

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.

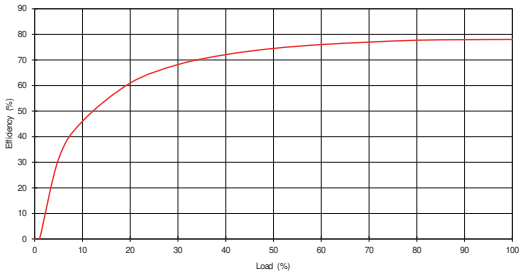
Inductor: The rated current of the inductor should not be less than that of the output of the DC-DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC-DC converter. The SRF (Self Resonant Frequency)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



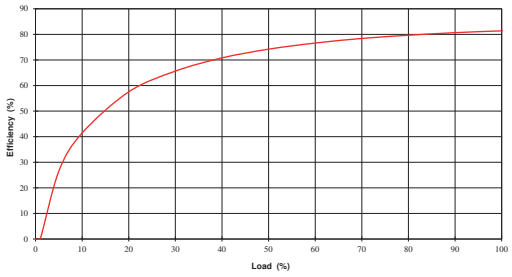
Recommended components:

	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
MMV1S0505SC	22	82223C	11R223C	1
MMV1S0524SC	47	82473C	11R473C	1

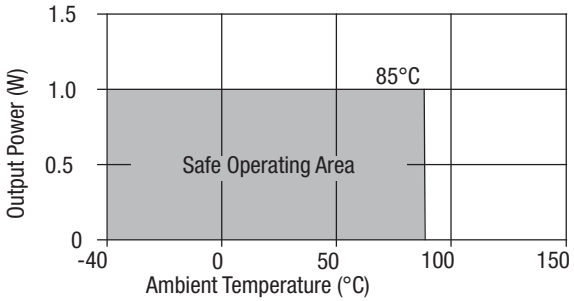
EFFICIENCY GRAPH - MMV1S0505SC



EFFICIENCY GRAPH - MMV1S0524SC



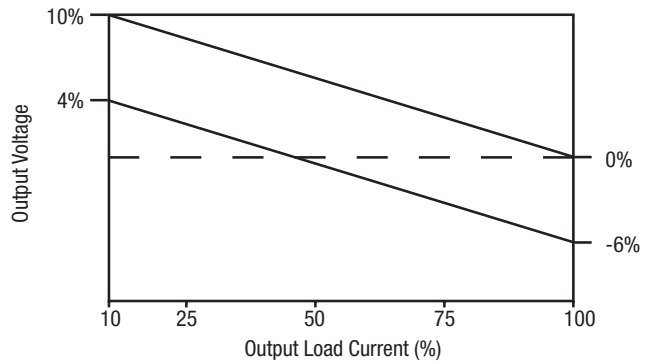
TEMPERATURE DERATING GRAPH



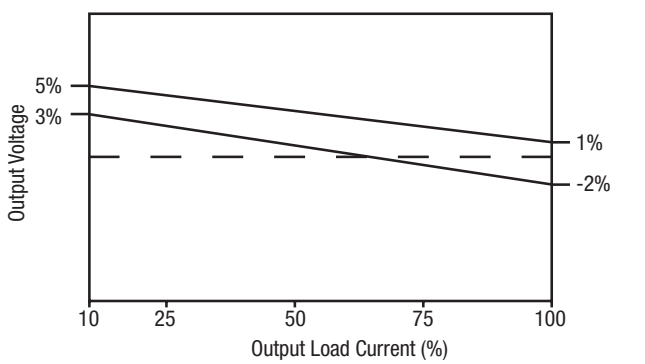
TOLERANCE ENVELOPE

The voltage tolerance envelopes show typical load regulation characteristics for this product series. The tolerance envelope is the maximum output voltage variation due to the changes in output loading.

MMV1S0505SC

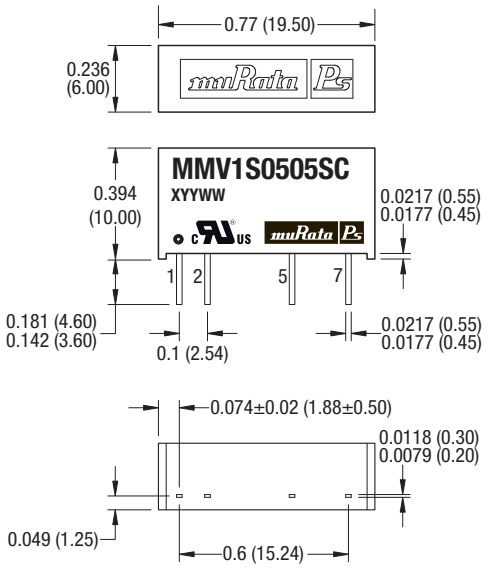


MMV1S0524SC



PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



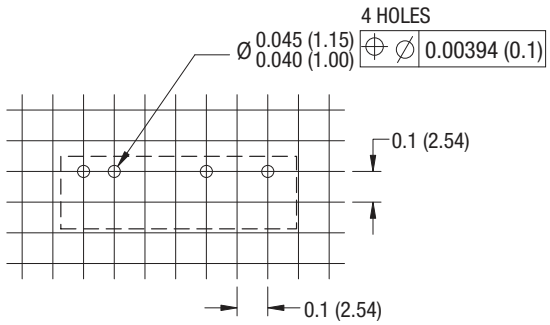
All dimensions in mm ±0.25mm (inches ±0.01). All pins on a 2.54 (0.1) pitch and within ±0.25 (0.01) of true position.
For SIP products, from date code D2224 onwards, products have an embossed logo on the top of the case.
Prior to this date, SIP products have a flat surface finish.

Weight: 2g

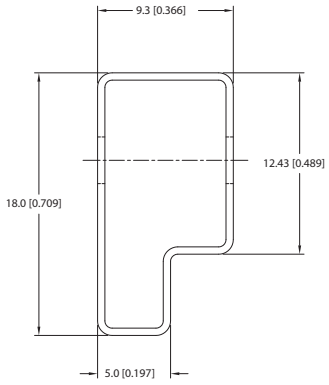
PIN CONNECTIONS

7 Pin SIP	
Pin	Function
1	$+V_{IN}$
2	$-V_{IN}$
5	$-V_{OUT}$
7	$+V_{OUT}$

RECOMMENDED FOOTPRINT DETAILS



TUBE OUTLINE DIMENSIONS



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].
Tube Length : 520mm [20.472] ±2.0 [0.079].

Tube quantity: 25

DISCLAIMER

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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- Aircraft equipment
- Aerospace equipment
- Undersea equipment
- Power plant control equipment
- Medical equipment
- Transportation equipment (automobiles, trains, ships, etc.)
- Traffic signal equipment
- Disaster prevention / crime prevention equipment
- Data Processing equipment

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