Murata Power Solutions

MEV1 Series

3kVDC Isolated 1W Single Output DC/DC Converters

FEATURES

- RoHS compliant
- Efficiency to 89% (Typ.)
- Power density 0.85W/cm³
- Wide temperature performance at full 1 Watt load, –40°C to 85°C
- UL 94V-0 package material
- No heatsink required
- Industry standard pinout
- 3kVDC isolation (1 minute)
- 5V, 12V, 15V, 24V, & 48V inputs
- 5V, 9V, 12V, & 15V output
- Fully encapsulated with toroidal magnetics
- No external components required
- No electrolytic or tantalum capacitors

PRODUCT OVERVIEW

The MEV series is the new high performance version of our 1W NMV series. The MEV series is more efficient and offers improved regulation performance ≤±5% for applications where a wide output voltage variation can not be tolerated. They are ideally suited for providing local supplies on control system boards with the added benefit of 3kVDC galvanic isolation to reduce switching noise. The MEV series is currently available in an industry SIP 7 package.

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)[1]	Ripple & Noise (Max)[1]	Efficiency (Min.)	Efficiency (Typ.)	Isolation Capacitance	MTTF[2]
	V	V	mA	mA	%		mVp-p		%	%	pF	kHrs
MEV1S0505SC	5	5	200	233	5.4	6.2	20	30	81	84	38	3583
MEV1S0509SC	5	9	111	227	4.2	5.5	12	20	83.5	86.5	42	3286
MEV1S0512SC	5	12	84	226	4.6	5.5	10	20	84	87	40	2886
MEV1S0515SC	5	15	67	225	4.5	5	8	15	85	87.5	39	2419
MEV1S1205SC	12	5	200	98	4.5	5	12	15	80	84	28	3308
MEV1S1209SC	12	9	111	96	3	3.3	8	15	83	86	50	3054
MEV1S1212SC	12	12	84	94	3	3.6	7	15	85.5	88	70	2705
MEV1S1215SC	12	15	67	94	2.5	2.9	7	15	83.5	88	59	2290
MEV1S1505SC	15	5	200	79	4	5	10	20	80	83.5	32	
MEV1S1509SC	15	9	111	77	2.5	3.5	8	20	82.5	86.5	52	
MEV1S1512SC	15	12	84	76	2.3	3.5	6	15	83.5	87.5	63	
MEV1S1515SC	15	15	67	76	2.5	3.5	6	15	85	89	87	
MEV1S2405SC	24	5	200	50	3.3	5	12	20	79	84	38	
MEV1S2409SC	24	9	111	48	2.2	3.5	8	20	81	86.5	56	
MEV1S2412SC	24	12	84	48	2	3.5	7	15	82	87.5	72	
MEV1S2415SC	24	15	67	48	1.8	3	7	15	82	87.5	83	
MEV1S4805SC	48	5	200	26	3.3	5	19	35	75.5	79.5	34	
MEV1S4809SC	48	9	111	25	2.4	3.5	13	25	78.5	82	54	
MEV1S4812SC	48	12	84	26	2	3	10	20	78	82	63	
MEV1S4815SC	48	15	67	26	1.9	3	9	20	79	82.5	74	

When operated **with** additional external load capacitance the rise time of the input voltage will determine the maximum external capacitance value for guaranteed start up. The slower the rise time of the input voltage the greater the maximum value of the additional external capacitance for reliable start up.

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	
	Continuous operation, 48V input types	43.2	48	52.8	
Reflected ripple current	5V input types		11	20	mA p-p
	12V input types		5	15	
	15V input types		3.5	10	
	24V input types		4.7	15	
	48V input types		22	50	

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	300°C
Input voltage V_{IN}, MEV05 types	7V
Input voltage V_{IN}, MEV12 types	15V
Input voltage Vin, MEV15 types	18V
Input voltage Vin, MEV24 types	28V
Input voltage Vin, MEV48 types	54V

1. See Ripple & Noise characterisation method.
2. Calculated using MIL-HDBK-217F FN2 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.

RoHS COMPLIANT 2002/95/EC

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	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN}		1.05	1.1	%/%

ISOLATION CHARACTERISTICS

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

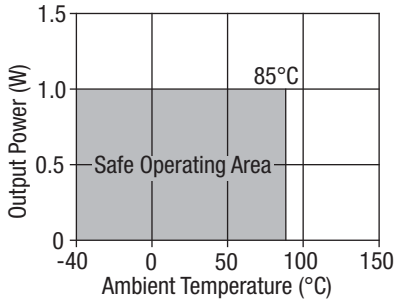
GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	5V input types		60		kHz
	12V input types		75		
	15V & 24V input types		85		
	48V input types		65		

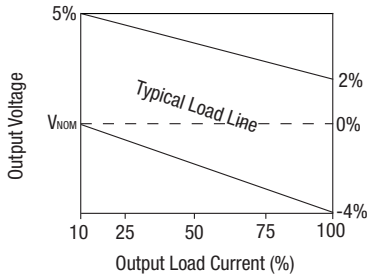
TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		125	
Case Temperature above ambient	24V & 48V input types			20	
	All other types			15	
Cooling	Free air convection				

TEMPERATURE DERATING GRAPH



TOLERANCE ENVELOPE



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.

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 MEV 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?"

For a part holding no specific agency approvals, such as the MEV 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 MEV 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.

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%.

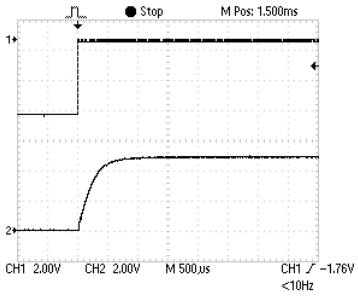
Capacitive loading and start up

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
MEV1S0505SC	585
MEV1S0509SC	1550
MEV1S0512SC	2700
MEV1S0515SC	4320
MEV1S1205SC	605
MEV1S1209SC	1750
MEV1S1212SC	3000
MEV1S1215SC	4800
MEV1S1505SC	660
MEV1S1509SC	1720

	Start-up time µs
MEV1S1512SC	3045
MEV1S1515SC	4445
MEV1S2405SC	440
MEV1S2409SC	4355
MEV1S2412SC	1855
MEV1S2415SC	2930
MEV1S4805SC	580
MEV1S4809SC	1320
MEV1S4812SC	2075
MEV1S4815SC	3235

Typical Start-Up Wave Form

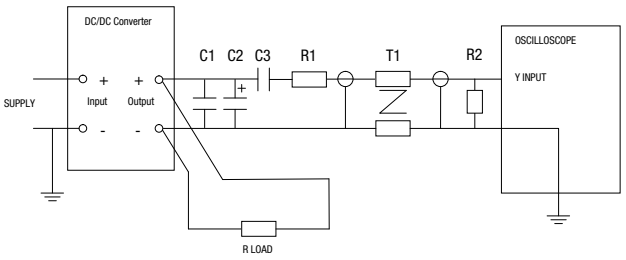


Ripple & Noise Characterisation Method

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)

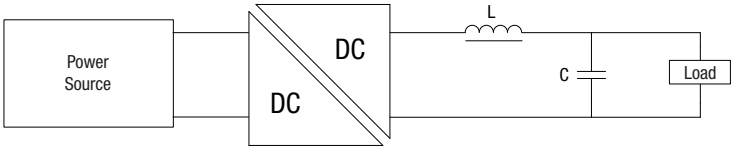
Output Ripple Reduction

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.

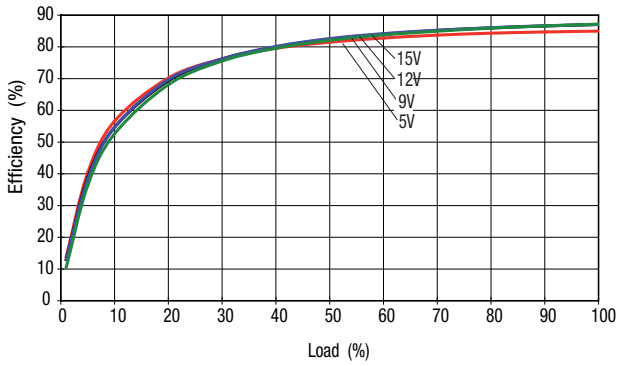
Inductor: The rated current of the inductor should not be less than that of the output of the DC/DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC/DC converter. The SRF (Self Resonant Frequency)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



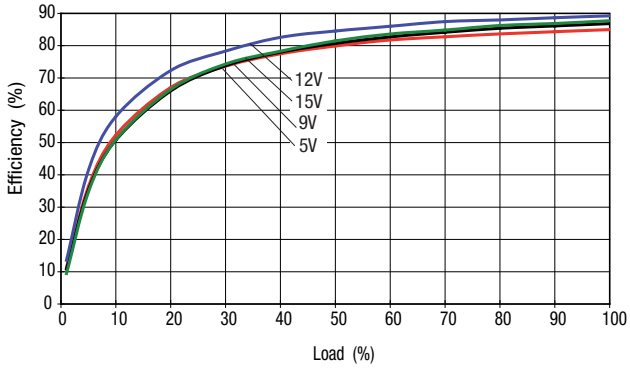
	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
MEV1S0505SC	10	82103C	11R103C	4.7
MEV1S0509SC	22	82223C	11R223C	2.2
MEV1S0512SC	47	82473C	11R473C	1
MEV1S0515SC	47	82473C	11R473C	1
MEV1S1205SC	10	82103C	11R103C	4.7
MEV1S1209SC	22	82223C	11R223C	2.2
MEV1S1212SC	47	82473C	11R473C	1
MEV1S1215SC	47	82473C	11R473C	1
MEV1S1505SC	10	82103C	11R103C	4.7
MEV1S1509SC	22	82223C	11R223C	2.2
MEV1S1512SC	47	82473C	11R473C	1
MEV1S1515SC	47	82473C	11R473C	1
MEV1S2405SC	10	82103C	11R103C	4.7
MEV1S2409SC	22	82223C	11R223C	2.2
MEV1S2412SC	47	82473C	11R473C	1
MEV1S2415SC	47	82473C	11R473C	1
MEV1S4805SC	10	82103C	11R103C	4.7
MEV1S4809SC	22	82223C	11R223C	2.2
MEV1S4812SC	47	82473C	11R473C	1
MEV1S4815SC	47	82473C	11R473C	1

EFFICIENCY VS LOAD

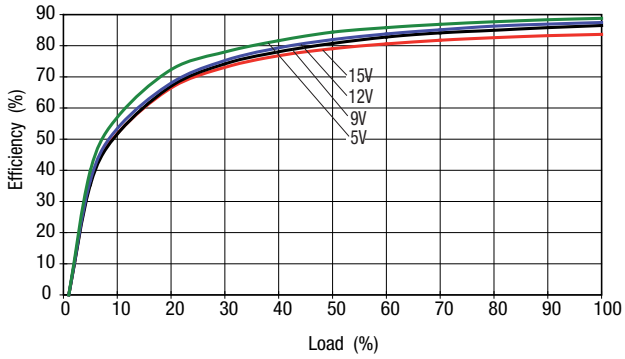
MEV1S05XXSC



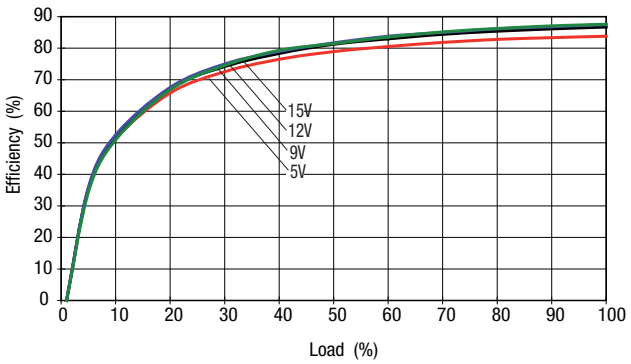
MEV1S12XXSC



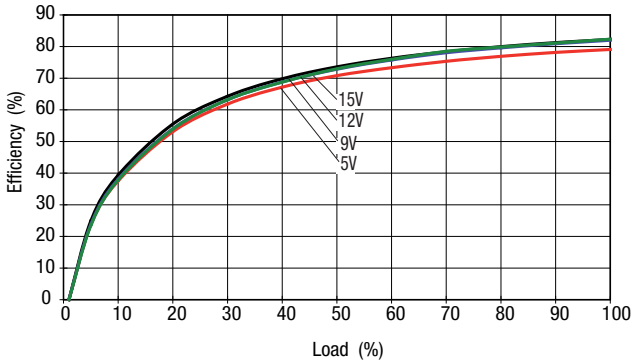
MEV1S15XXSC



MEV1S24XXSC



MEV1S48XXSC



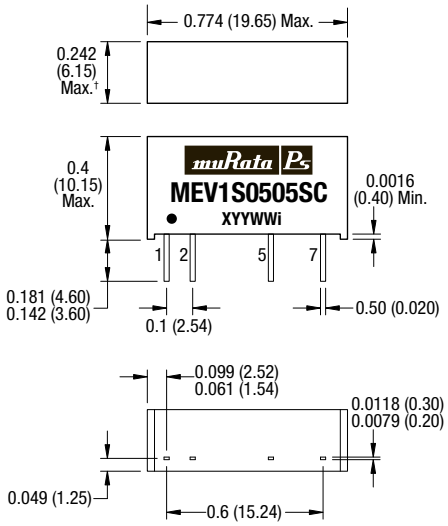
RoHS COMPLIANT INFORMATION

RoHS COMPLIANT 2002/95/EC

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 300°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

PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS



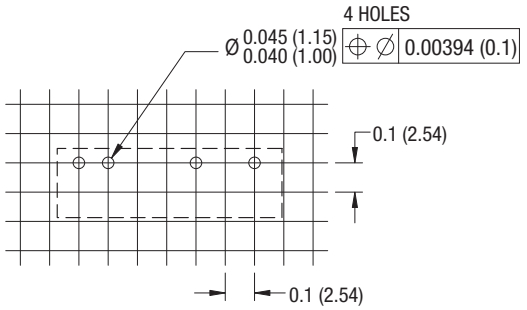
Weight: 2.5g
48V inputs 2.8g

Unless otherwise stated, all dimensions in inches ±0.01 (mm ±0.25mm). All pins on a 0.1 (2.54) pitch and within ±0.01 (0.25) of true position.
† 48V input variants 0.301 (7.65)

PIN CONNECTIONS

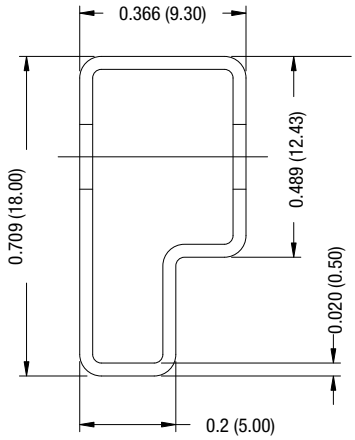
Pin	Function
1	+V_{IN}
2	-V_{IN}
5	-V_{OUT}
7	+V_{OUT}

RECOMMENDED FOOTPRINT DETAILS



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

TUBE OUTLINE DIMENSIONS



Tube Quantity : 25

Unless otherwise stated all dimensions in inches (mm) ±0.5mm.
Tube length : 20.47 (520mm ±2mm).

Murata Power Solutions

Murata Power Solutions, Inc.
11 Cabot Boulevard, Mansfield, MA 02048-1151 U.S.A.
Tel: (508) 339-3000 (800) 233-2765 Fax: (508) 339-6356
www.murata-ps.com email: sales@murata-ps.com ISO 9001 & ISO 14001 REGISTERED

USA: Mansfield (MA), Tel: (508) 339 3000, email: sales@murata-ps.com
Canada: Toronto, Tel: (866) 740 1232, email: toronto@murata-ps.com
UK: Milton Keynes, Tel: +44 (0)1908 615232, email: mk@murata-ps.com
France: Montigny Le Bretonneux, Tel: +33 (0)1 34 60 01 01, email: france@murata-ps.com
Germany: München, Tel: +49 (0)89-544334-0, email: ped.munich@murata-ps.com
Japan: Tokyo, Tel: 3-3779-1031, email: sales_tokyo@murata-ps.com
Osaka, Tel: 6-6354-2025, email: sales_osaka@murata-ps.com
China: Shanghai, Tel: +86 215 027 3678, email: shanghai@murata-ps.com
Guangzhou, Tel: +86 208 221 8066, email: guangzhou@murata-ps.com
Singapore: Parkway Centre, Tel: +65 6348 9096, email: singapore@murata-ps.com