

## FEATURES

- UL 60950 Recognition pending
- Wide temperature performance at full 1 Watt load, -40°C to 85°C
- UL 94V-0 package material
- Industry standard pinout
- 3kVDC isolation (1 minute) 'Hi Pot Test'
- 5V & 12V inputs
- 5V, 12V & 15V output
- Fully encapsulated with toroidal magnetics
- No external components required
- No electrolytic or tantalum capacitors

## PRODUCT OVERVIEW

The CRV1 series of industrial temperature range DC/DC converters are the standard building blocks for on-board distributed power systems. They are ideally suited for providing local supplies on control system boards with the added benefit of 3kVDC galvanic isolation to reduce switching noise. Available in SIP package with dual and single output pinout. All of the rated power may be drawn from a single output rail provided the total load does not exceed 1 watt.

## 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) <sup>1</sup>	Ripple & Noise (Max) <sup>1</sup>	Efficiency (Min)	Efficiency (Typ)	Isolation Capacitance	MTTF <sup>2</sup>	
	V	V	mA		%		mVp-p		%		pF	MIL. kHrs	Tel. kHrs
	<b>CRV1S0505SC</b>	5	5	200	294	11	14	16	23	67	70	23	4241
<b>CRV1D0512SC</b>	5	±12	±42	256	5	7	6.7	8	76	79	26	1579	
<b>CRV1D1212SC</b>	12	±12	±42	111	4	5	6	10	77	81	42	1287	
<b>CRV1S1215SC</b>	12	15	67	108	4	5	8.5	17	79	83	42	1462	

## 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	
Reflected ripple current	All input types		20	40	mA p-p

## OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	T <sub>A</sub> = -40°C to 85°C, See derating curve			1	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V <sub>IN</sub> to low V <sub>IN</sub>		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	5V input types		120		kHz
	12V input types		150		

## ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	260°C
Input voltage V <sub>IN</sub> , 5V input	7V
Input voltage V <sub>IN</sub> , 12V input	15V

## TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		125	
Case Temperature above ambient	5V output types			28	
	All other output types			25	
Cooling	Free air convection				

1. See Ripple & Noise characterisation method.
2. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.

All specifications typical at T<sub>A</sub> = 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 CRV1 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 CRV1 is pending recognition 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 CRV1 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 CRV1 series is pending recognition 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 (case temperature measured on the face opposite the pins).

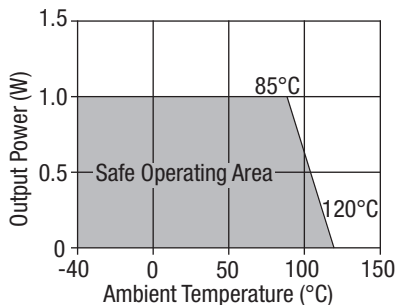
**RoHS COMPLIANT INFORMATION**



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. Both types in this series is backward compatible with Sn/Pb soldering systems.

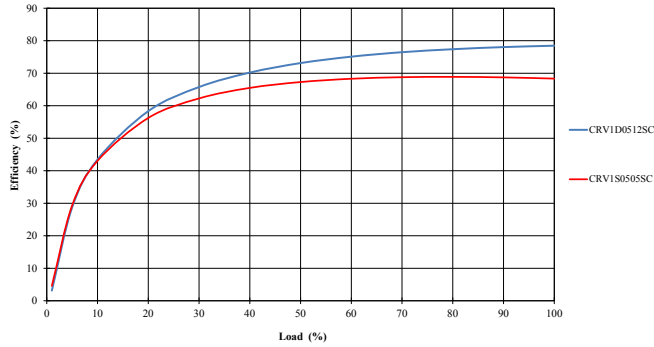
For further information, please visit [www.murata-ps.com/rohs](http://www.murata-ps.com/rohs)

**TEMPERATURE DERATING GRAPH**

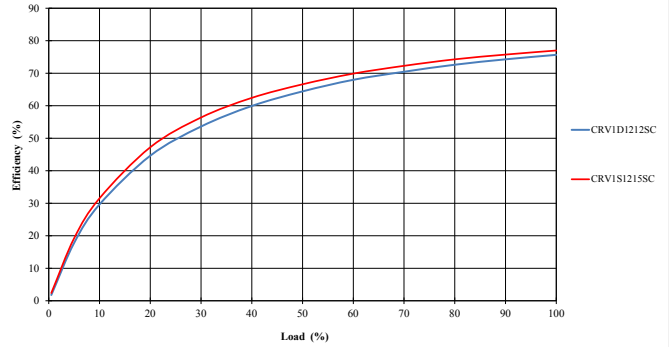


## EFFICIENCY VS LOAD

5V Inputs



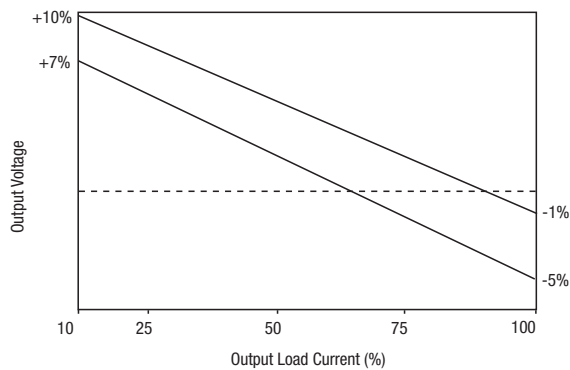
12V Inputs



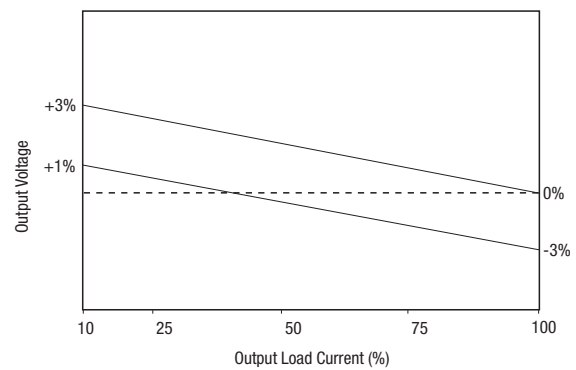
## TOLERANCE ENVELOPES

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.

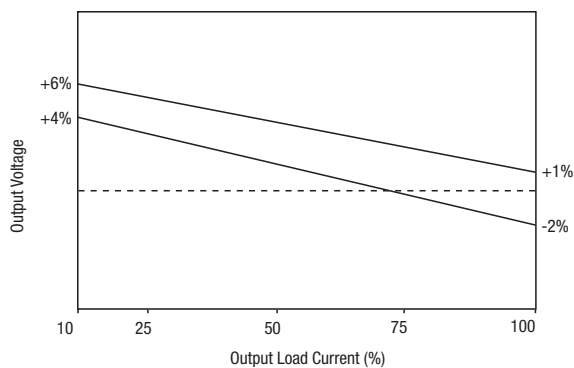
CRV1S0505SC



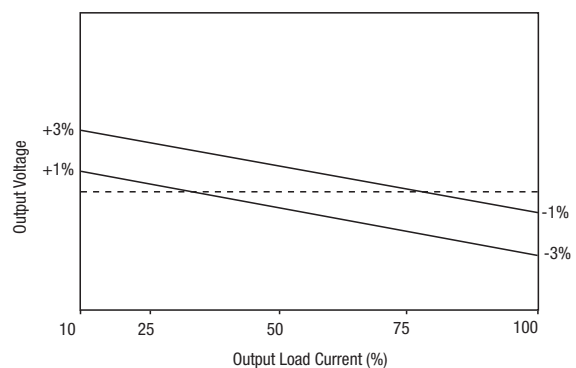
CRV1S1215SC



CRV1D0512SC



CRV1D1212SC



**APPLICATION NOTES**

**Minimum load**

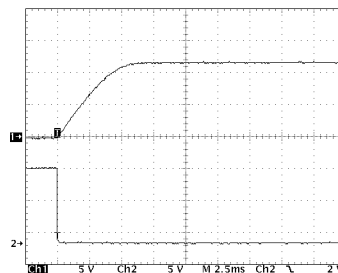
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

**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
CRV1S0505SC	1966
CRV1D0512SC	11180
CRV1D1212SC	8650
CRV1S1215SC	11171

Typical Start-Up Wave Form

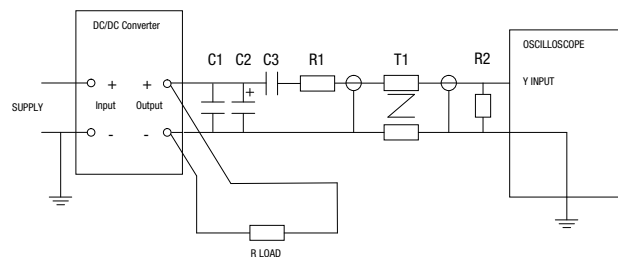


**Ripple & Noise Characterisation Method**

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)**

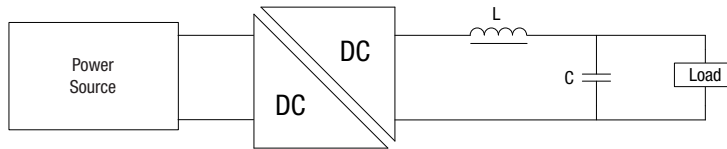
**Output Ripple Reduction**

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.

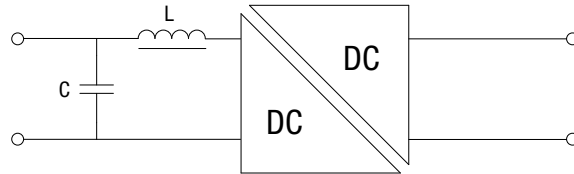


	Inductor			Capacitor
	L, $\mu$ H	SMD	Through Hole	C, $\mu$ F
CRV1S0505SC	22	82223C	11R223C	1
CRV1D0512SC	150	82154C	11R154C	0.33
CRV1D1212SC	150	82154C	11R154C	0.33
CRV1S1215SC	220	82224C	11R224C	0.22

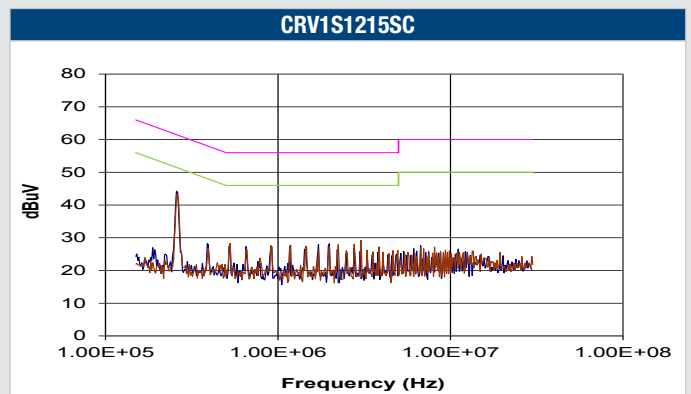
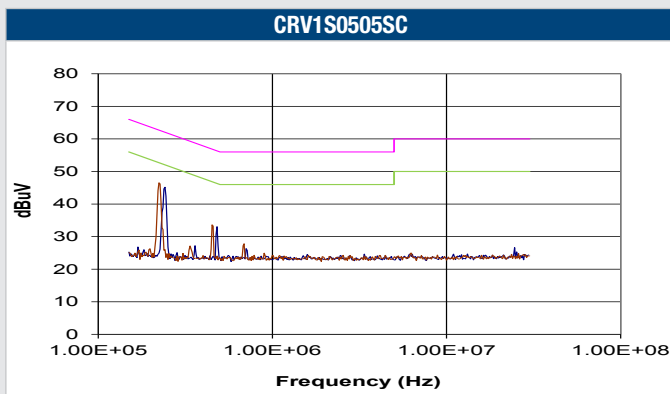
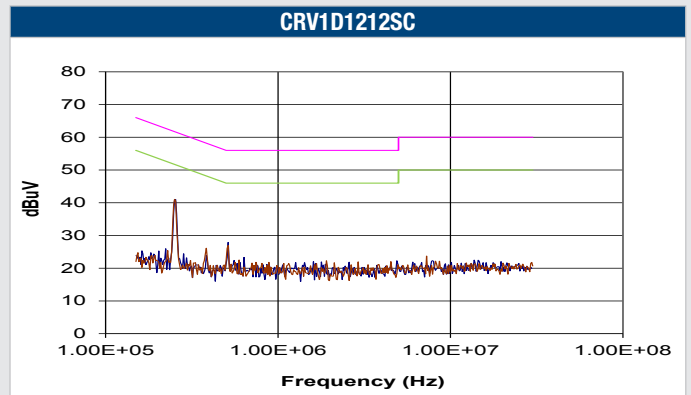
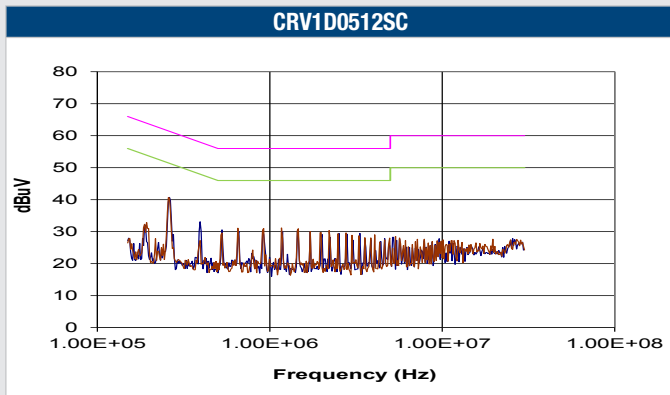
**EMC FILTERING AND SPECTRA**

**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. The recommended input capacitor to use for this circuit is 50V 16V X7R ceramic capacitor.

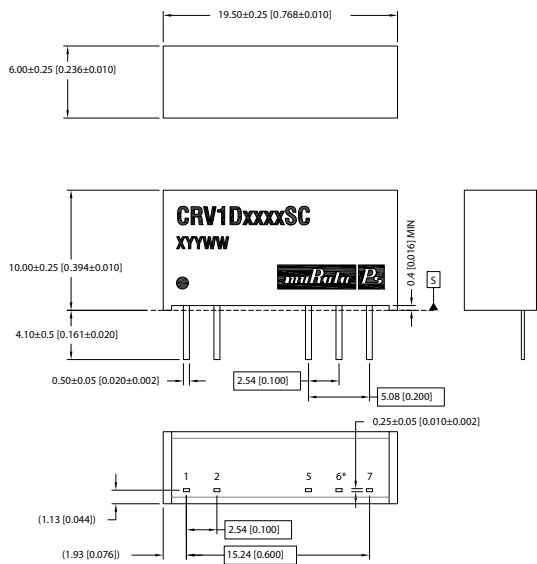


Part Number	Inductor		Capacitor
	L, $\mu$ H	SMD	Through Hole
CRV1D0512SC	10 $\mu$ H		13R103C
CRV1S0505SC	10 $\mu$ H		13R103C
CRV1D1212SC	10 $\mu$ H		13R103C
CRV1S1215SC	4.7 $\mu$ H		13R472C



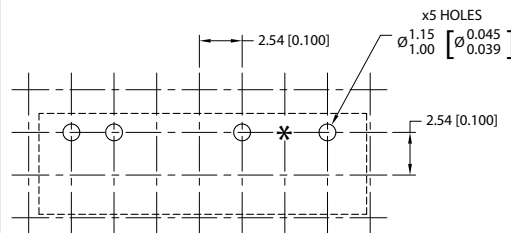
## PACKAGE SPECIFICATIONS

### MECHANICAL DIMENSIONS



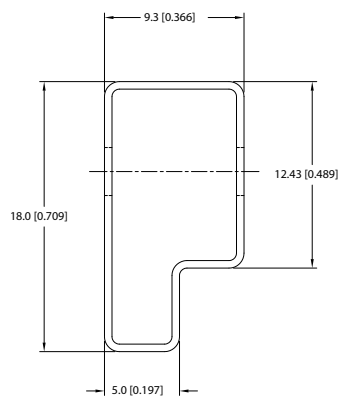
\* Pin not fitted on single output variants.  
 All dimensions in mm (inches) Controlling dimension is mm.  
 All pins on a 2.54 (0.100) pitch and within ±0.1 (0.004) of true position from pin 1 at seating plane 'S' position. Weight: 2.1g

### RECOMMENDED FOOTPRINT DETAILS



\*Hole not required for single output variants.

### TUBE OUTLINE DIMENSIONS



Unless otherwise specified all dimensions in mm [inches] ±0.55mm.  
 Tube length : 20.47 (520mm ±2mm). Tube Quantity : 35

### PIN CONNECTIONS

Single output variants

Dual output variants

Pin	Function
1	V <sub>IN</sub>
2	GND
5	-V <sub>out</sub>
7	+V <sub>out</sub>

Pin	Function
1	V <sub>IN</sub>
2	GND
5	-V <sub>out</sub>
6*	OV
7	+V <sub>out</sub>

Murata Power Solutions, Inc.  
 11 Cabot Boulevard, Mansfield, MA 02048-1151 U.S.A.  
 ISO 9001 and 14001 REGISTERED



This product is subject to the following **operating requirements** and the **Life and Safety Critical Application Sales Policy**:  
 Refer to: <http://www.murata-ps.com/requirements/>

Murata Power Solutions, Inc. makes no representation that the use of its products in the circuits described herein, or the use of other technical information contained herein, will not infringe upon existing or future patent rights. The descriptions contained herein do not imply the granting of licenses to make, use, or sell equipment constructed in accordance therewith. Specifications are subject to change without notice.  
 © 2016 Murata Power Solutions, Inc.