

## FEATURES

■ UL 60950 Recognised
■ Wide temperature performance at full 1 Watt load, -40°C to 85°C
■ UL 94V-0 package material
■ Industry standard pinout
■ 1kVDC isolation 'Hi Pot Test'
■ 5V Input
■ 5V Output
■ Fully encapsulated with toroidal magnetics
■ No external components required
■ No electrolytic or tantalum capacitors

## PRODUCT OVERVIEW

The CRR1 series of industrial temperature range DC/DC converters is the standard building block for on-board distributed power systems. It is ideally suited for providing single rail supplies on primarily digital boards with the added benefit of galvanic isolation to reduce switching noise. Surface mount technology and advanced packaging materials produce rugged reliable performance over an extended temperature range from -40°C to 85°C.

## SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Input Current at Rated Load	Load Regulation (Typ)	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						
CRR1S0505SC	5	5	200	290	12	14	6	10	67	69	28 1847

## INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation	4.5	5	5.5	V
Reflected ripple current			1.6	2	mA p-p

## OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power <sup>3</sup>	T <sub>A</sub> =-40°C to 85°C, See derating curve			1.0	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 second	1000			VDC
Resistance	V <sub>ISO</sub> = 1000VDC	10			GΩ

## GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency			110		kHz

## ABSOLUTE MAXIMUM RATINGS

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

## TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification		-40		85	
Storage		-50		130	
Case Temperature above ambient				33	°C
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.

3. See derating graph.

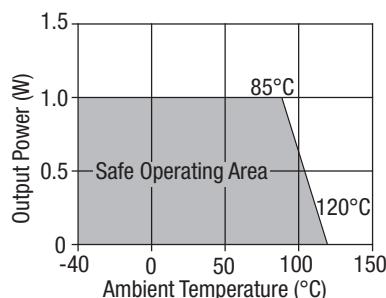
All specifications typical at T<sub>A</sub>=25°C, nominal input voltage and rated output current unless otherwise specified.



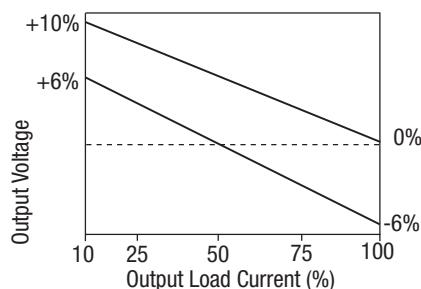
For full details go to  
[www.murata-ps.com/rohs](http://www.murata-ps.com/rohs)



**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 CRR1 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 CRR1 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 CRR1 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 CRR1 series has been recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum still air ambient temperature of 100°C as measured at any point on the case of the unit (hotspot).

The CRR1 series of converter is not internally fused so to meet requirements of UL 60950 an anti-surge input line fuse should always be used with ratings as defined below.

Input Voltage, 5V: 0.5A

All fuses should be UL recognized, 125V rated.

File number E151252 applies.

**RoHS COMPLIANCE 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 this product series is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The 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)

**APPLICATION NOTES**

**Minimum load**

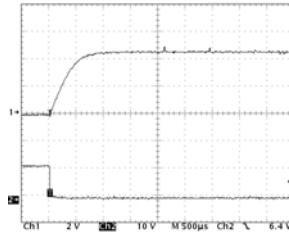
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

**Capacitive loading and start up**

Typical start up times for this series, with a typical input voltage rise time of 2.2 $\mu$ s and output capacitance of 10 $\mu$ F, are shown in the table below. The product series will start into a capacitance of 47 $\mu$ F with an increased start time, however, the maximum recommended output capacitance is 10 $\mu$ F.

Typical Start-Up Wave Form

Start-up time	
	$\mu$ s
CRR1S0505SC	2301



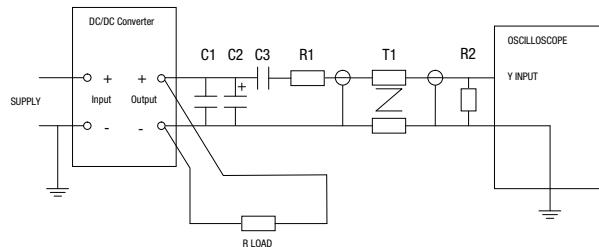
**Ripple & Noise Characterisation Method**

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

C1	1 $\mu$ F X7R multilayer ceramic capacitor, voltage rating to be a minimum of 3 times the output voltage of the DC/DC converter
C2	10 $\mu$ F 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 100m $\Omega$ at 100 kHz
C3	100nF multilayer ceramic capacitor, general purpose
R1	450 $\Omega$ resistor, carbon film, $\pm 1\%$ tolerance
R2	50 $\Omega$ 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)**

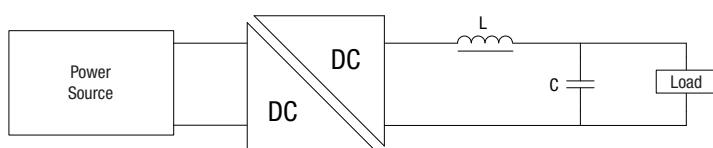
**Output Ripple Reduction**

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.

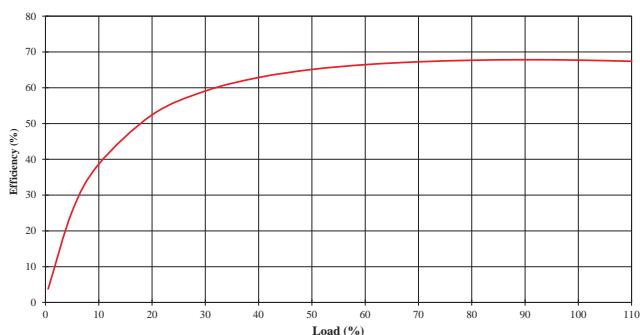
Inductor: The rated current of the inductor should not be less than that of the output of the DC/DC converter. At the rated current, the DC resistance of the inductor should be such that the voltage drop across the inductor is <2% of the rated voltage of the DC/DC converter. The SRF (Self Resonant Frequency)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



	Inductor			Capacitor
	L, $\mu$ H	SMD	Through Hole	C, $\mu$ F
CRR1S0505SC	10	82103C	11R103C	4.7

**EFFICIENCY VS LOAD**

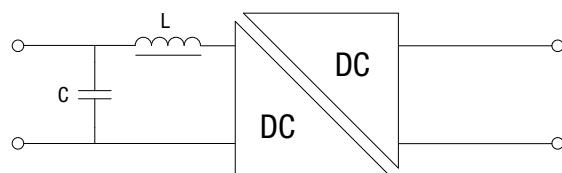
**CRR1S0505SC**



**EMC FILTERING AND SPECTRA**

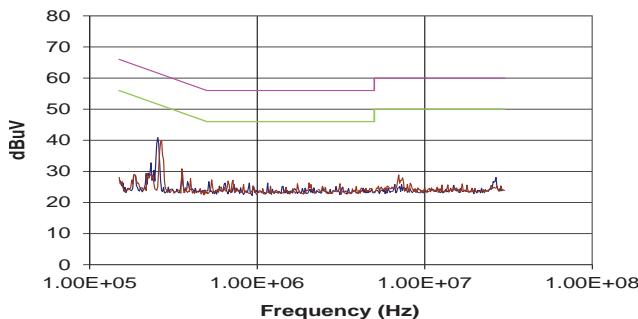
**FILTERING**

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.



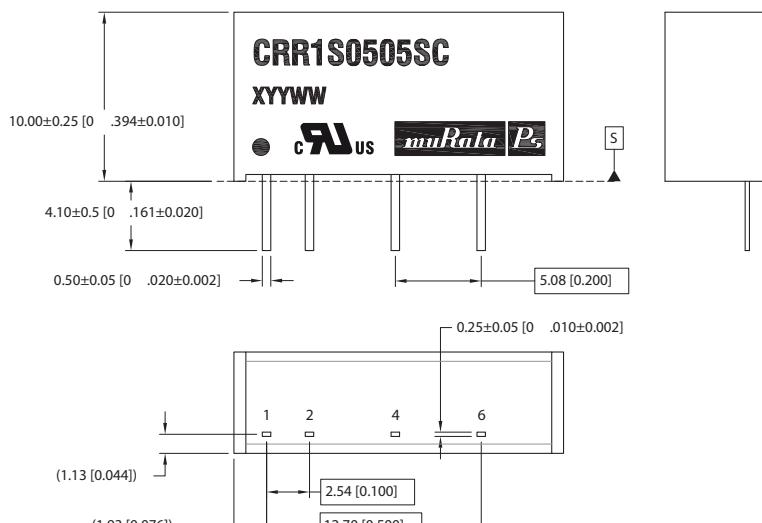
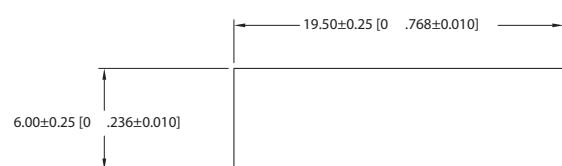
Part Number	Inductor		Capacitor	
	L, $\mu$ H	SMD	Through Hole	C, $\mu$ F
CRR1S0505SC	4.7		13R472C	4.7

**CRR1S0505SC**



**PACKAGE SPECIFICATIONS**

**MECHANICAL DIMENSIONS**

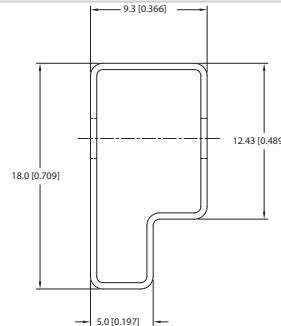


All dimensions in mm (inches) Controlling dimension is mm.  
All pins on a 2.54 (0.100) pitch and within ±0.1 (0.004) of true position from pin 1 at seating plane 'S'

**PIN CONNECTIONS**

Pin	Function
1	+V <sub>IN</sub>
2	-V <sub>IN</sub>
4	-V <sub>OUT</sub>
6	+V <sub>OUT</sub>

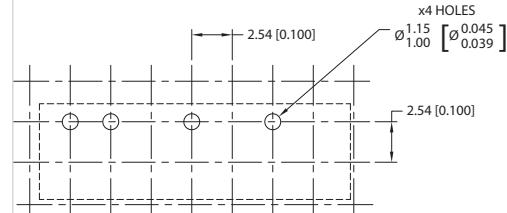
**TUBE OUTLINE DIMENSIONS**



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

Tube quantity: 35

**RECOMMENDED FOOTPRINT DETAILS**



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

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.

© 2017 Murata Power Solutions, Inc.