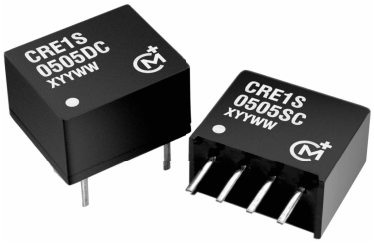
Murata Power Solutions

CRE1 Series

Isolated 1W Single Output Isolated DC/DC Converters



FEATURES

- UL 60950 recognition pending
- Single Isolated output
- 1kVDC or 3kVDC option 'Hi Pot Test'
- Wide temperature performance at full 1W load -40°C to 85°C[2]
- Industry Standard Pinout
- 3.3V, 5V, 12V & 24V Inputs
- 5V, 12V & 15V outputs
- Pin Compatible with CME, CRL2, LME, MEE1, MEE3, NKE, NME, & NML series

PRODUCT OVERVIEW

The CRE1 series are a cost effective 1W DC/DC converter series, in industry standard packages with industry standard pinout. Popular input and output voltages are available. 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].

SELECTION GUIDE

Order Code[2]	Nominal Input Voltage	Output Voltage	Output Current	Load Regulation		Ripple & Noise		Input Current at Rated Load	Efficiency		Isolation Capacitance	MTTF[1]	
	V	V	mA	%		mV p-p		mA	%		pF	MIL.	Tel.
				Typ.	Max.	Typ.	Max.		Min.	Typ.		kHrs	
CRE1S0505DC	5	5	200	12	14	16	40	286	67	70	30		
CRE1S0505SC	5	5	200	12	14	16	40	286	67	70	30		
CRE1S0515SC	5	15	67	6	7.5	10	25	250	77	80	40		
CRE1S1205SC	12	5	200	8	10	12	30	117	68	71	33		
CRE1S1212SC	12	12	83	4	5	8	20	104	75	80	55		
CRE1S2405SC	24	5	200	8.5	10	13	30	58	67	71	40		
CRE1S2412SC	24	12	83	3	4	10	25	52	75	80	78		
3KVDC isolation options													
CRE1S0305S3C	3.3	5	200	10	12	15	25	400	72	75	35		
CRE1S0505S3C	5	5	200	6	8	15	25	250	73	77	24		

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	Continuous operation, 3.3V input types	2.97	3.3	3.63	V
	Continuous operation, 5V input types	4.5	5.0	5.5	
	Continuous operation, 12V input types	10.8	12	13.2	
	Continuous operation, 24V input types	21.6	24	26.4	
Reflected ripple current	3.3V & 12V input types		1	15	mA p-p
	5V & 24V input types		2	15	

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power	T_A=-40°C to 85°C[2]			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	C Versions Flash tested for 1 second	1000			VDC
	3C Versions Flash tested for 1 second	3000			
Resistance	Viso= 1000VDC		10		GΩ

GENERAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	3.3V input types		115		kHz
	5V input types		110		
	12V input types		145		
	24V input types		100		

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	260°C
Input voltage V_{IN}, 3.3V input	5.5V
Input voltage V_{IN}, 5V input	7V
Input voltage V_{IN}, 12V input	15V
Input voltage V_{IN}, 24V input	28V

1. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
2. 24V input parts operating temperature range is currently 0°C to 70°C, parts are being upgraded to -40°C to 85°C operating temperature range.

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

TEMPERATURE CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	24V Input types[2]	0		70	°C
	All other inputs types	-40		85	
Storage		-50		130	
Case temperature rise above ambient	5V output types			41	
	All other output types			32	
Cooling	Free air convection				

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 CRE1 series of DC/DC converters are all 100% production tested at their stated isolation voltage. This is 1kVDC for 1 second for C versions and 3kVDC for 1 second for 3C versions.

A question commonly asked is, "What is the continuous voltage that can be applied across the part in normal operation?"

The CRE1 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 CRE1 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

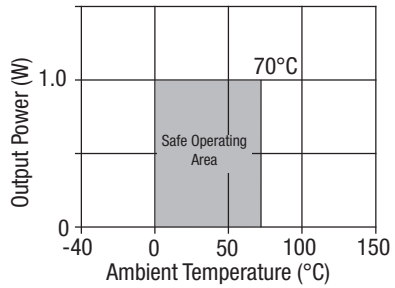
The CRE1 series is pending recognition by Underwriters Laboratory (UL) to UL 60950 for functional insulation in a maximum still air ambient temperature of 85°C and/or case temperature limit (case temperature measured on the face opposite the pins).

RoHS COMPLIANCE INFORMATION

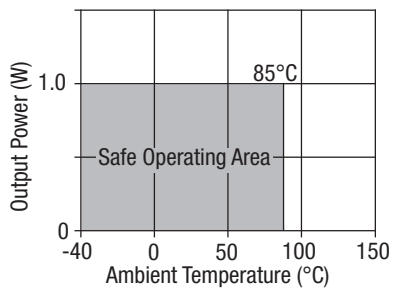
This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260°C for 10 seconds. The pin termination finish on the SIP package type is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The DIP types are Matte Tin over Nickel Preplate. Both types in this series are backward compatible with Sn/Pb soldering systems.

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

TEMPERATURE DERATING GRAPH[2]

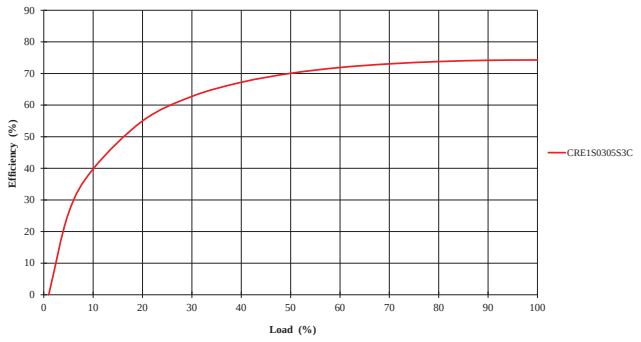


TEMPERATURE DERATING GRAPH

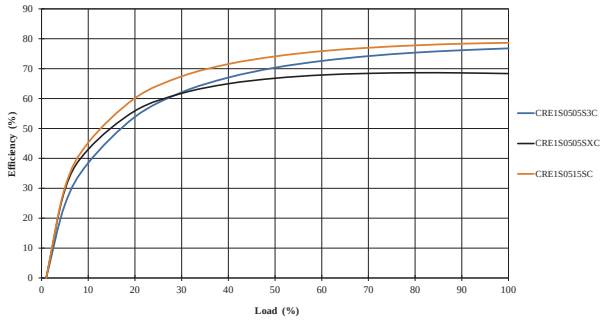


EFFICIENCY VS LOAD

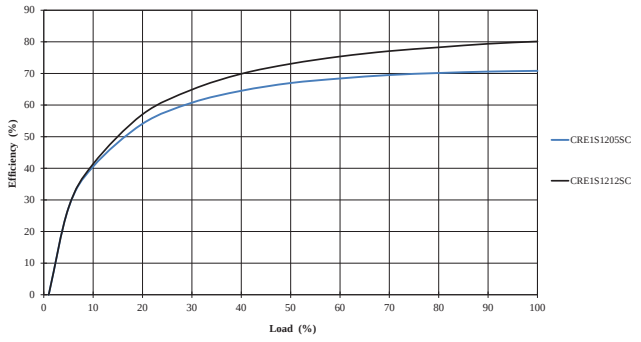
3.3V Inputs



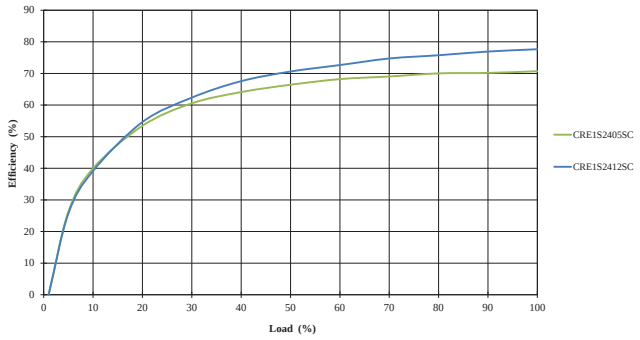
5V Inputs



12V Inputs



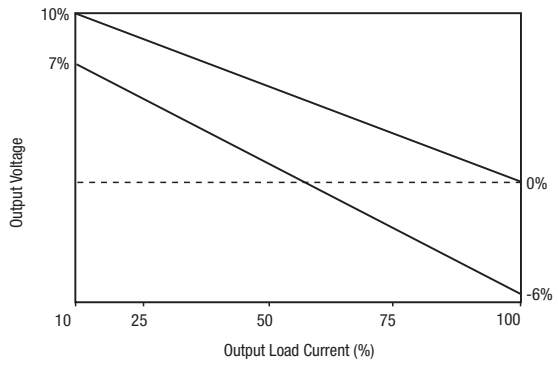
24V Inputs



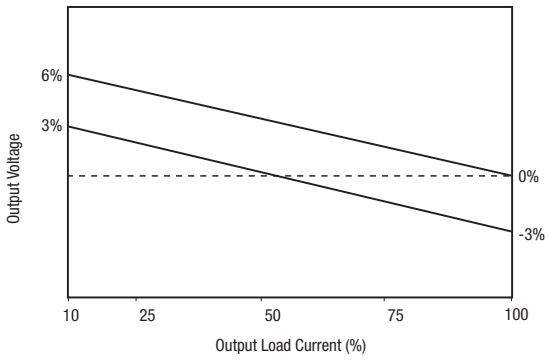
TOLERANCE ENVELOPES

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.

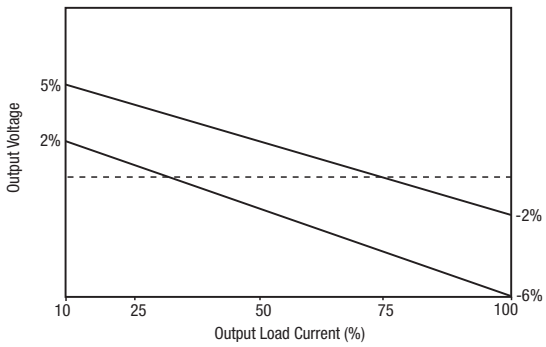
CRE1S0505XC



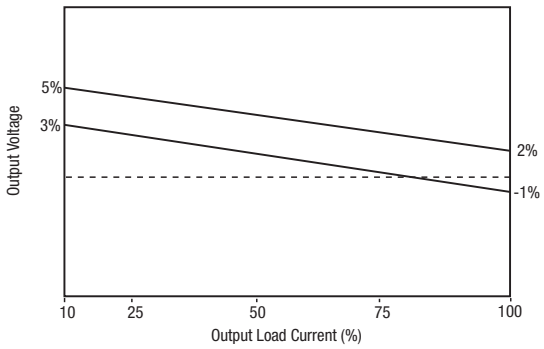
CRE1S0515SC



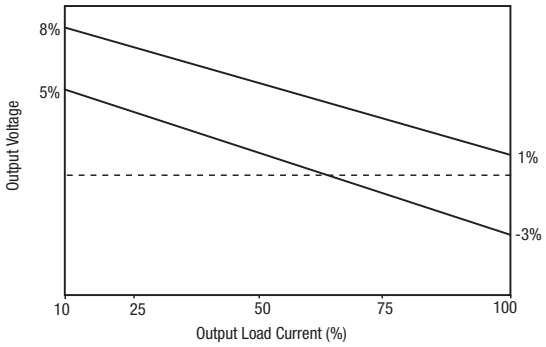
CRE1S1205SC



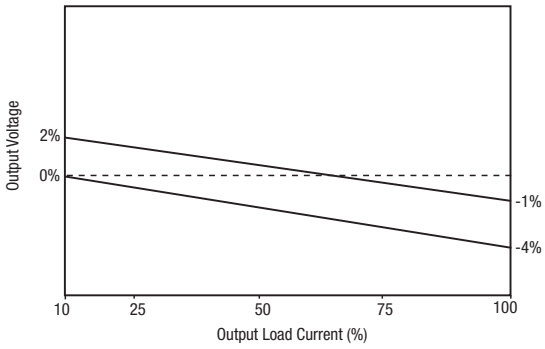
CRE1S1212SC



CRE1S2405SC

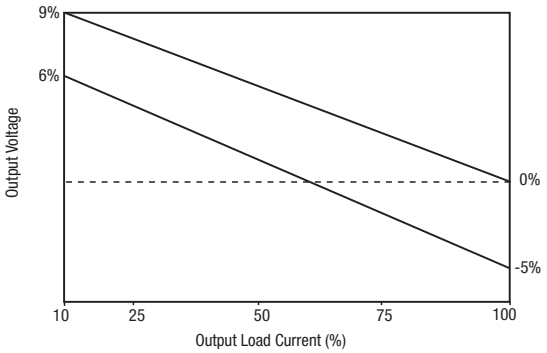


CRE1S2412SC

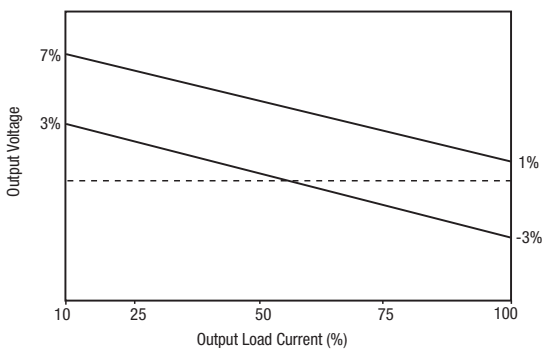


TOLERANCE ENVELOPES (continued)

CRE1S0305S3C



CRE1S0505S3C



APPLICATION NOTES

Minimum load

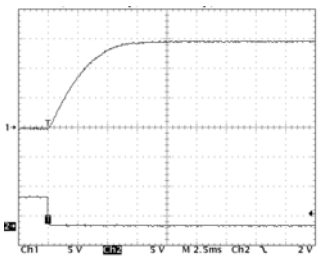
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

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
CRE1S0505DC	190
CRE1S0505SC	190
CRE1S0515SC	1790
CRE1S1205SC	125
CRE1S1212SC	500
CRE1S2405SC	135
CRE1S2412SC	430
CRE1S0305S3C	295
CRE1S0505S3C	165

Typical Start-Up Wave Form



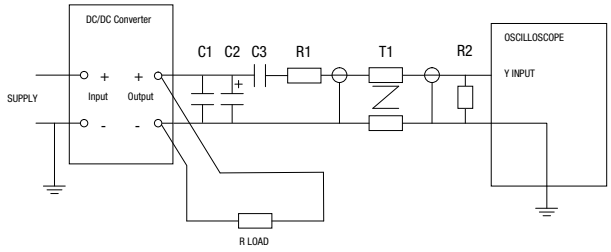
APPLICATION NOTES (continued)

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



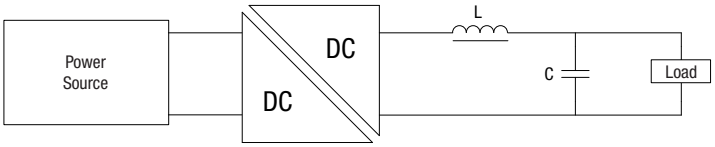
Output Ripple Reduction

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.

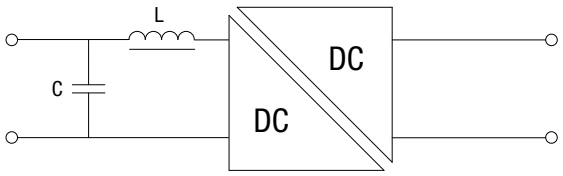


	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
CRE1S0505DC				
CRE1S0505SC				
CRE1S0515SC				
CRE1S1205SC				
CRE1S1212SC				
CRE1S2405SC				
CRE1S2412SC				
CRE1S0305S3C				
CRE1S0505S3C				

EMC FILTERING AND SPECTRA

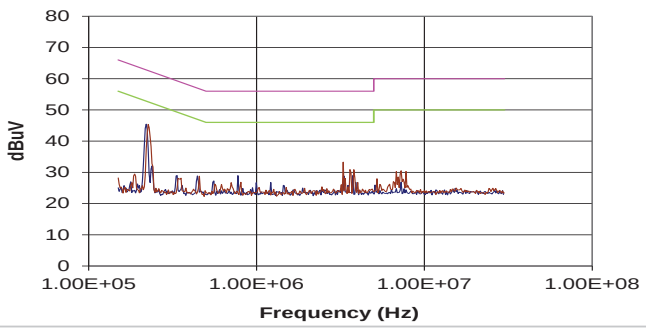
FILTERING

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

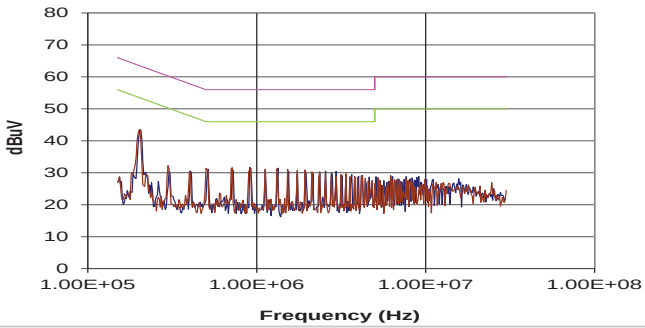


	Inductor			Capacitor
Part Number	L, µH	SMD	Through Hole	C, µF
CRE1S0505DC	4.7		13R472C	4.7
CRE1S0505SC	4.7		13R472C	4.7
CRE1S0515SC	4.7		13R472C	4.7
CRE1S1205SC	10		13R103C	1
CRE1S1212SC	10		13R103C	1
CRE1S2405SC	22		13R223C	10
CRE1S2412SC	22		13R223C	10
CRE1S0305S3C	10		13R103C	1
CRE1S0505S3C	10		13R103C	1

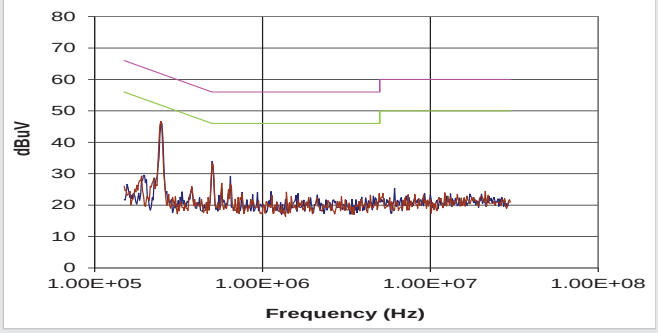
CRE1S0505XC



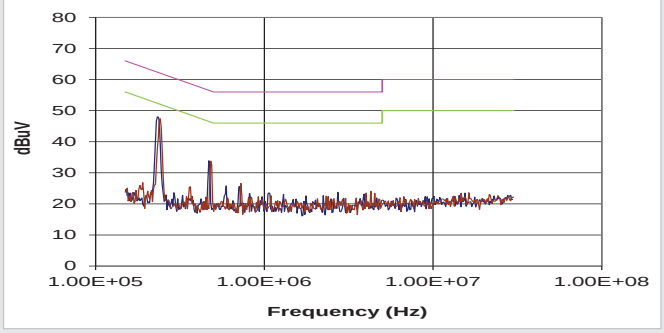
CRE1S0515SC



CRE1S1205SC

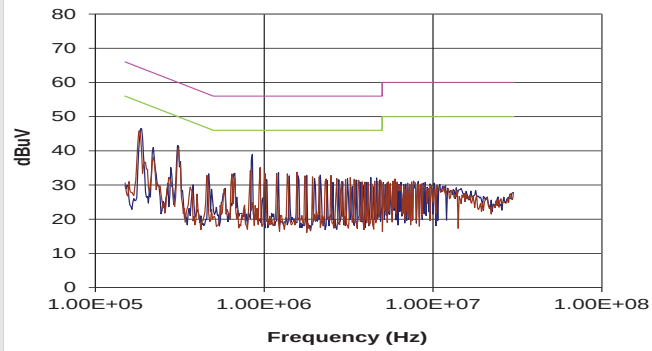


CRE1S1212SC

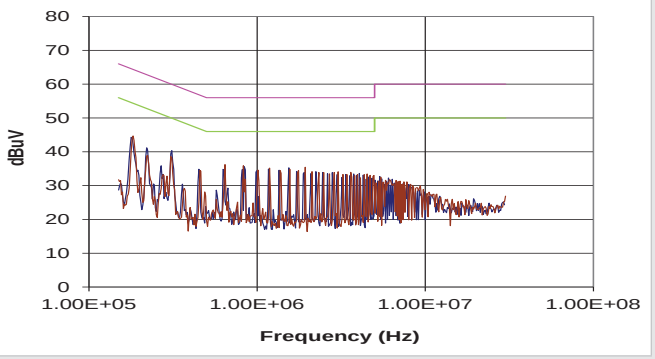


EMC FILTERING AND SPECTRA

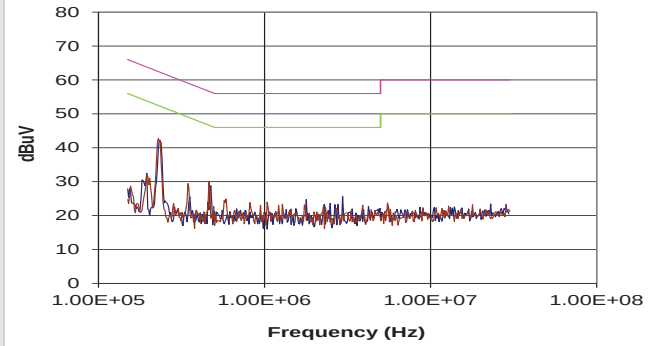
CRE1S2405SC



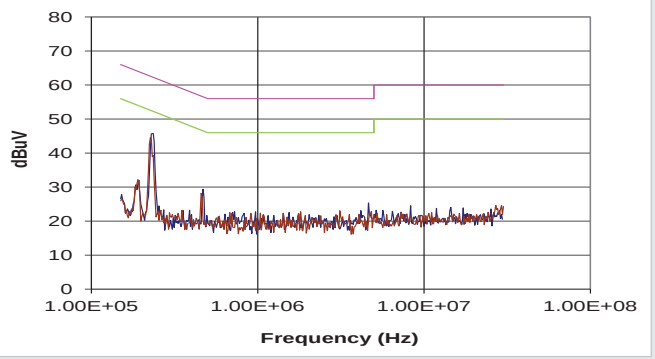
CRE1S2412SC



CRE1S0305S3C

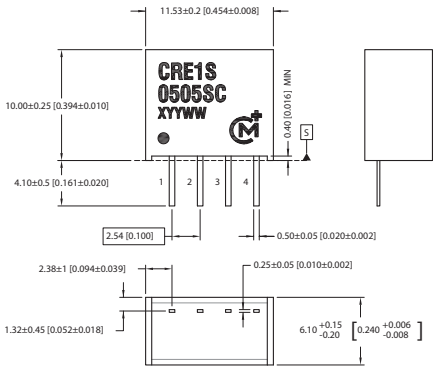


CRE1S0505S3C

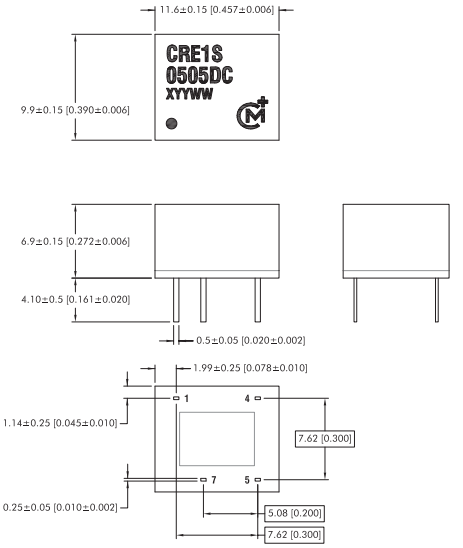


PACKAGE SPECIFICATIONS

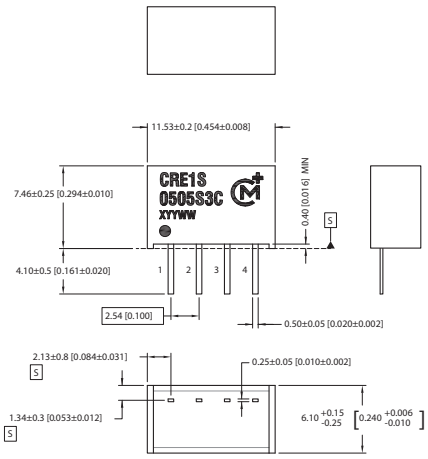
SC Package



DC Package



3C 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' (SC&3C)

All pins on a 2.54 (0.100) pitch and within ±0.25 (0.010) of true position (DC)

Weight: 1.09g (3C) 1.30g (SC) 1.38g (DC)

PIN CONNECTIONS - 4 PIN SIP

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

PIN CONNECTIONS - 8 PIN DIP

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

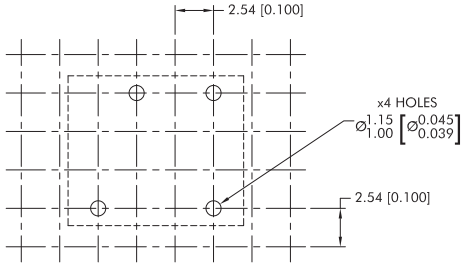
PIN CONNECTIONS - 4 PIN 3C

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

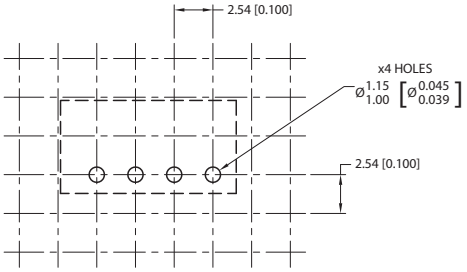
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

DC

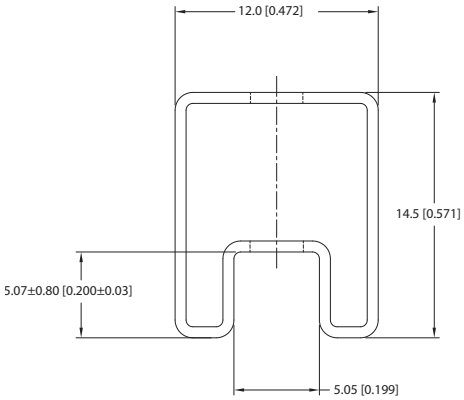


SC/3C

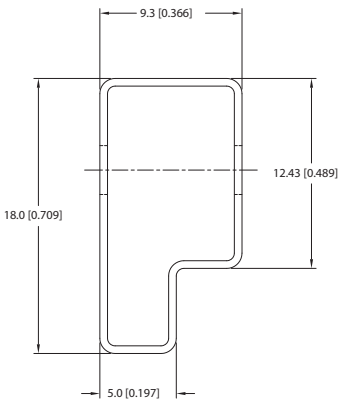


TUBE OUTLINE DIMENSIONS

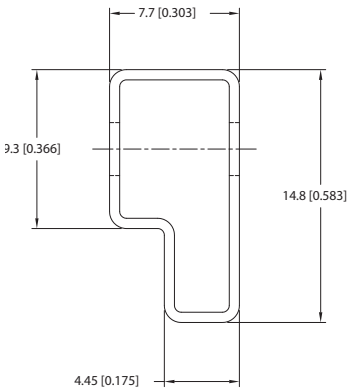
DC Tube



SC Tube



3C Tube



Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].
Tube Length (DC&SC) : 520mm [20.472] ±2.0 [0.079]
Tube Length (3C) : 525mm [20.669] ±2.0 [0.079].

Tube Quantity (DC & SC): 35
(3C):40

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