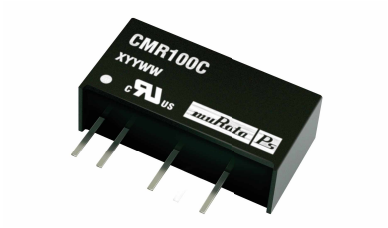
Murata Power Solutions

CMR Series

Isolated 0.75W Single and Dual Output Isolated DC/DC Converters



FEATURES

- Short circuit protection options
- UL 60950 recognised
- Single or Dual Isolated Outputs
- 1kVDC or 3kVDC options 'Hi Pot Test'
- Wide temperature performance at full 0.75W load -40°C to 85°C
- Industry Standard Pinouts
- 5V, 12V and 24V Inputs
- 5V, 12V and 15V Outputs
- Pin compatible with NMR, MER1, MMV, MEV1, NMK, MEV3, NMV series.

DESCRIPTION

The CMR series are a cost effective 0.75W DC/DC converter series, in an industry standard package with industry standard pinouts, Popular input and output voltages are available as a lower power alternative to a 1W DC/DC converter. 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 0.75 watt output at 85°C. For the short circuit protected parts (PC) protection is continuous and auto-resetting on removal of the short circuit.

SELECTION GUIDE

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Load Regulation		Ripple & Noise[3]		Input Current at rated load	Efficiency		Isolation Capacitance	MTTF[1]	
	V	V	mA	% Typ.	% Max	mV p-p Typ.	mV p-p Max.	mA	% Min.	% Typ.	pF	MIL. kHrs	Tel. kHrs
CMR100C	5	5	150	9	11	6	10	218	65	69	30	1850	
CMR118C	24	5	150	6.8	10	8	15	46	65	70	60	1250	
3kVDC Isolation Options													
CMR0505SA3C	5	5	150	9	11	15	25	220	64	68	30	4240	
CMR0512S3C	5	±12	±31	5	6	6.7	8	192	74	78	30	1560	
CMR0515S3C	5	±15	±25	4	6	6.3	8.2	188	76	79	30	1060	
CMR1215S3C	12	±15	±25	3	4.5	6.5	13	80	76	79	40	925	
Short Circuit Protection Options													
CMR100PC	5	5	150	7.5	9	10	25	200	73	75.5	22	3095	61060
CMR0505SAP3C[4]	5	5	150	7.5	9	20	40	195	74	76	20	2680	56444

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, 24V input types	21.6	24	26.4	
Input short circuit current	Short circuit variants		95		mA
Input reflected ripple current	CMR100PC		2	15	mA p-p
	CMR0505SAP3C		5	15	
	5V & 12V input types		2.6	4	
	24V input types		10	15	

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Rated Power[2]	T_A=-40°C to 85°C			0.75	W
Voltage Set Point Accuracy	See tolerance envelope				
Line regulation	High V_{IN} to low V_{IN} ; Short circuit types		1.15	1.2	%/%
	High V_{IN} to low V_{IN} ; All other output types		1.0	1.2	

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation voltage	C versions flash tested for 1 second	1000			VDC
	3C versions flash tested for 1 minute	3000			
Resistance	Viso=1000VDC	10			GΩ

ABSOLUTE MAXIMUM RATINGS

Lead temperature 1.5mm from case for 10 seconds	260°C
5V input types	7V
12V input types	15V
24V input types	28V

1. Calculated using MIL-HDBK-217 FN2 and Telcordia SR-332 calculation model with nominal input voltage at full load.
2. See derating graph.
3. See ripple & noise characterisation method.
4. 3kVDC Isolation

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

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GENERAL CHARACTERISTICS

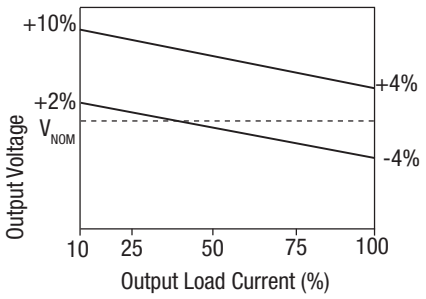
Parameter	Conditions	Min.	Typ.	Max.	Units
Switching frequency	5V input types		110		kHz
	12V input types		120		
	24V input types		80		
	CMR100PC		97		
	CMR0505SAP3C		88		

TEMPERATURE CHARACTERISTICS

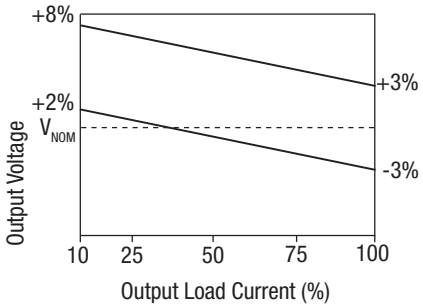
Parameter	Conditions	Min.	Typ.	Max.	Units
Specification	All output types	-40		85	°C
Storage		-50		125	
Case Temperature above ambient	5V output types		33		
	All other output types		28		
	1kVDC short circuit types		18		
	3kVDC short circuit types		19		
Cooling	Free air convection				

TOLERANCE ENVELOPES

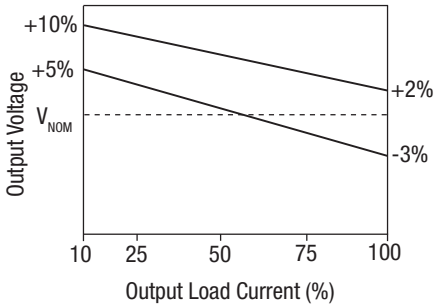
All 5V output types:



All other output types:



Short circuit types:



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 CMR 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 minute for 3C versions.

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

The CMR is 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 CMR 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

UL60950

The CMR is recognised by Underwriters Laboratory (UL) to UL 60950 for functional insulation. The CMR100C and CMR118C in a maximum still air ambient temperature of 100°C as measured at any point on the case of the unit (hotspot).

FUSING

The CMR Series of converters are not internally fused so to meet the requirements of UL an anti-surge input line fuse should always be used with ratings as defined below.

CMR100xC: 0.5A
CMR118C: 0.12A
CMR05xxxx3C: 0.315A
CMR12xxxx3C: 1A

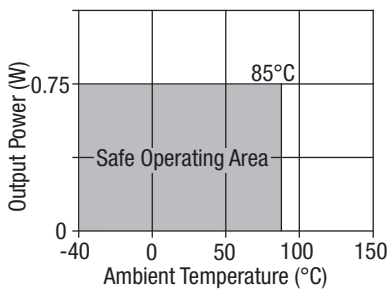
All fuses should be UL recognized and rated to 125V.
File number E151252 applies.

RoHS COMPLIANCE INFORMATION

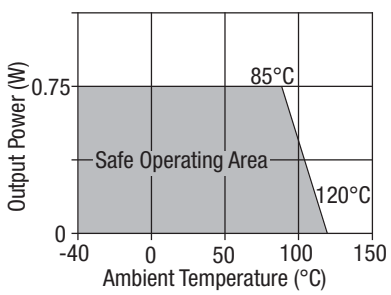
This series is compatible with RoHS soldering systems with a peak wave solder temperature of 260ºC for 10 seconds. The pin termination finish on this product series is Tin Plate, Hot Dipped over Matte Tin with Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems.
For further information, please visit www.murata-ps.com/rohs

TEMPERATURE DERATING GRAPHS

Short Circuit types only.



All other types.



EFFICIENCY VS LOAD

CMR100C

CMR118C

CMR0505SA3C

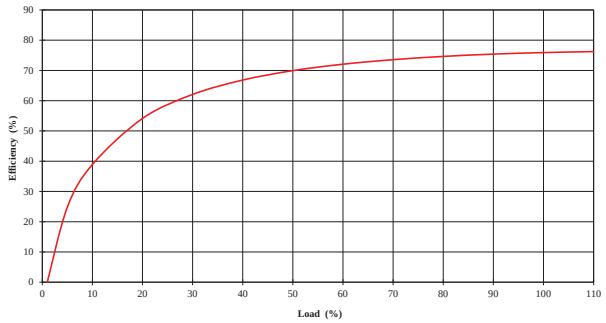
CMR0512S3C

CMR0515S3C

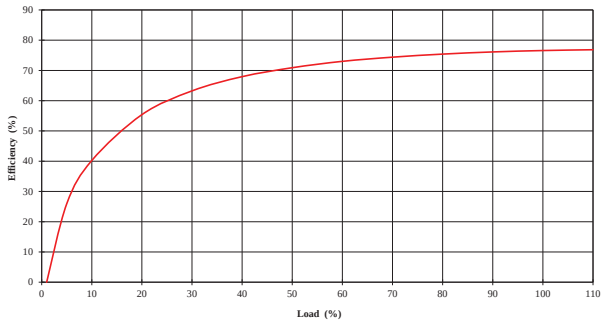
CMR1215S3C

EFFICIENCY VS LOAD

CMR100PC



CMR0505SAP3C



APPLICATION NOTES

Minimum load

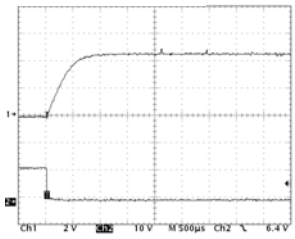
The minimum load to meet datasheet specification is 10% of the full rated load across the specified input voltage range. Lower than 10% minimum loading will result in an increase in output voltage, which may rise to typically double the specified output voltage if the output load falls to less than 5%.

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
CMR100C	2300
CMR118C	670
CMR0505SA3C	1970
CMR0512S3C	11200
CMR0515S3C	16300
CMR1215S3C	11200
CMR100PC	360
CMR0505SAP3C	370

Typical Start-Up Wave Form

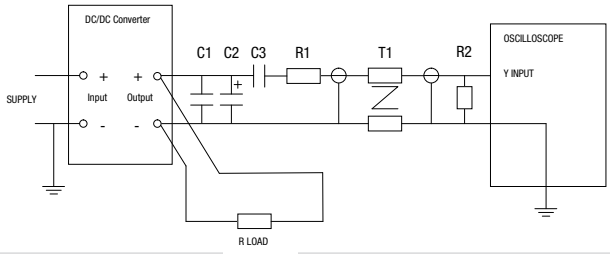


Ripple & Noise Characterisation Method

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)

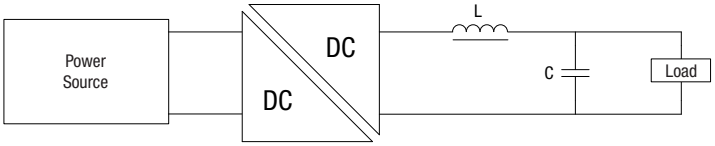
Output Ripple Reduction

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.

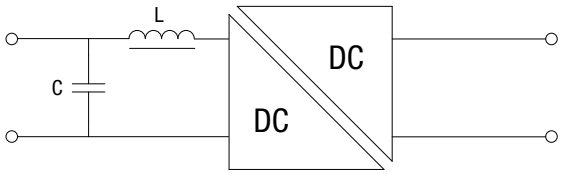


	Inductor			Capacitor
	L, µH	SMD	Through Hole	C, µF
CMR100C	10	82103C	11R103C	4.7
CMR118C	10	82103C	11R103C	4.7
CMR0505SA3C	22	82223C	11R223C	1
CMR0512S3C	150	82154C	11R154C	0.33
CMR0515S3C	220	82224C	11R224C	0.33
CMR1215S3C	220	82224C	11R224C	0.22
CMR100PC	22	82223C	11R223C	1
CMR0505SAP3C	22	82223C	11R223C	1

EMC FILTERING AND SPECTRA

FILTERING

The following filter circuit and filter table shows the input filters 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.



C Ceramic capacitor

	Inductor			Capacitor
Part Number	L, µH	SMD	Through Hole	C, µF
CMR100C				
CMR118C				
CMR0505SA3C				
CMR0512S3C				
CMR0515S3C				
CMR1215S3C				
CMR100PC	22	82223C	11R223C	1
CMR0505SAP3C				

CMR100C

CMR118C

CMR0505SA3C

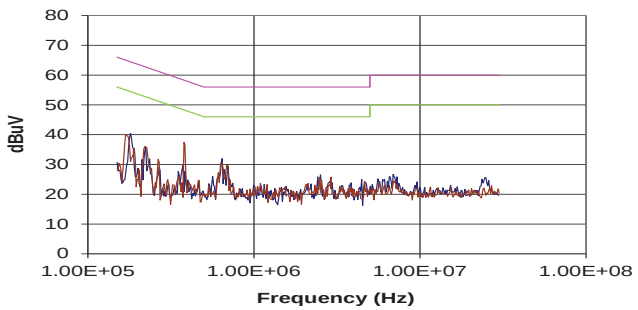
CMR0512S3C

EMC FILTERING AND SPECTRA

CMR0515S3C

CMR1215S3C

CMR100PC

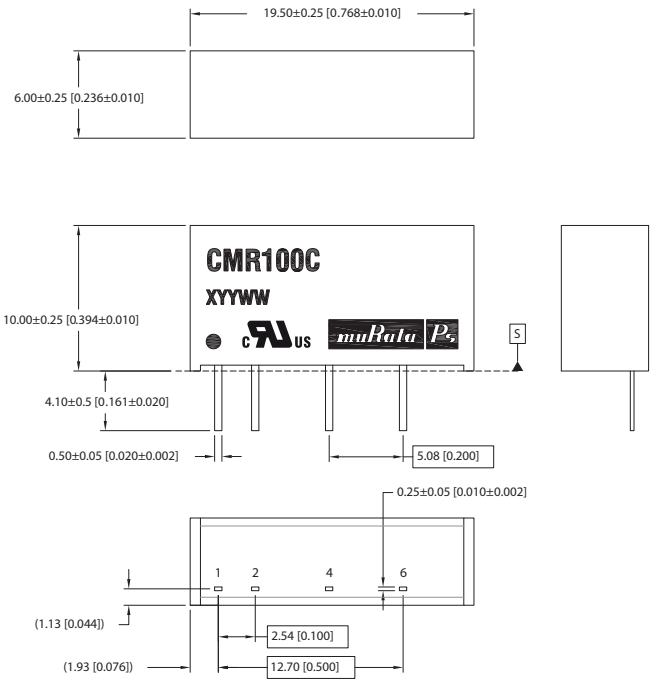


CMR0505SAP3C

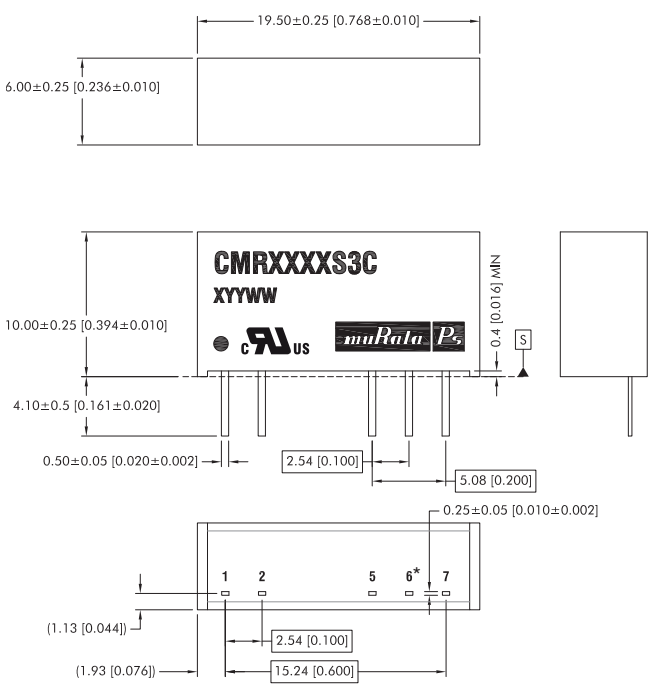
PACKAGE SPECIFICATIONS

MECHANICAL DIMENSIONS

C Package



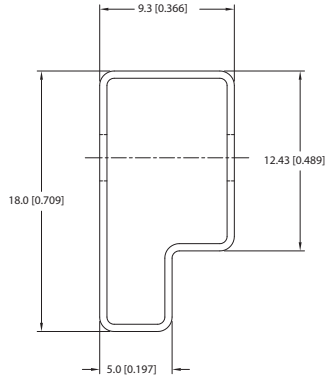
3C Package



*PIN 6 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'

Weight: 2.1g (C) 2.0g (3C) 1.9g (PC)

TUBE OUTLINE DIMENSIONS



Tube Length : 520mm [20.472] ±2.0 [0.079]. Tube quantity: 25
Unless otherwise specified all dimensions in mm [inches] ±0.55mm [0.022].

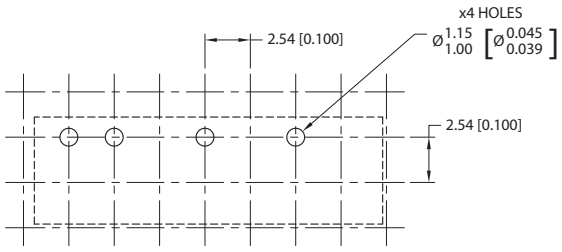
PIN CONNECTIONS

PIN	C	3C	
		Single	Dual
1	+V_{IN}	+V_{IN}	+V_{IN}
2	-V_{IN}	-V_{IN}	-V_{IN}
4	-V_{OUT}		
5		-V_{OUT}	-V_{OUT}
6	+V_{OUT}		0V
7		+V_{OUT}	+V_{OUT}

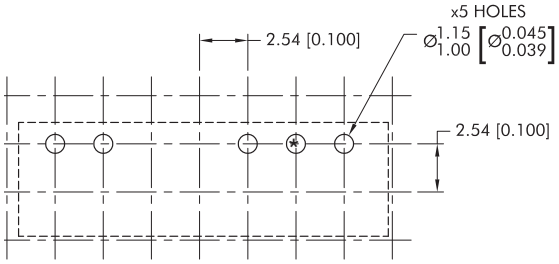
PACKAGE SPECIFICATIONS (continued)

RECOMMENDED FOOTPRINT DETAILS

C Package



3C Package



* Hole not required for single output variants
All dimensions in millimetres ±0.25 (inches ±0.1)