

Features

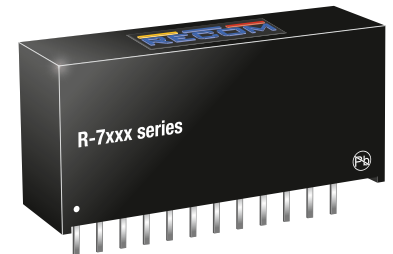
Switching Regulator

- Non-isolated
- Synchronous rectification design
- Adjustable output voltage
- 2, 3, 4Amp adjustable positive step down
- Integrated switching regulator
- Over load protection
- Continuous short circuit protection
- Efficiency up to 97%

RECOM
DC/DC Converter

R-7xxxP_D

**2,3,4 Amp
SIP12
Vertical &
Horizontal
Single Output**



IEC/EN60950-1 certified

Description

The R-7xxx series is a high performance 2.5V to 17V, 2Amp to 4Amp, 12-Pin SIP (single in-line package), integrated switching regulator (ISR). The synchronous - rectified design yields excellent efficiencies up to 97%. Short circuit protection reduces the short circuit input current to under 50mA.

Selection Guide

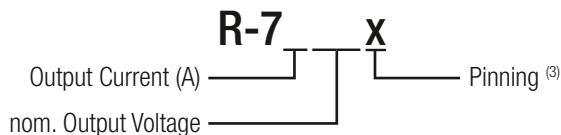
Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Vout Adjust Range ⁽¹⁾ [VDC]	Output Current [A]	Efficiency @ min Vin [%]	Efficiency @ max. Vin [%]	Max. Capacitive Load ⁽²⁾ [μF]
R-723.3x	4.5 - 28	3.3	2.5 - 5.5	2	95	89	200/6800
R-725.0x	6.5 - 28	5.0	3.0 - 5.5	2	96	91	200/6800
R-726.5x	8.5 - 28	6.5	5.0 - 8.0	2	97	93	200/6800
R-729.0x	12 - 28	9.0	7.0 - 11	2	96	93	200/6800
R-7212x	15 - 28	12	10 - 14	2	97	95	200/6800
R-7215x	19 - 28	15	13 - 17	2	97	96	200/6800
R-733.3x	4.5 - 28	3.3	2.5 - 5.5	3	94	89	200/6800
R-735.0x	6.5 - 28	5.0	3.0 - 5.5	3	95	92	200/6800
R-736.5x	8.5 - 28	6.5	5.0 - 8.0	3	97	93	200/6800
R-739.0x	12 - 28	9.0	7.0 - 11	3	96	94	200/6800
R-7312x	15 - 28	12	10 - 14	3	97	96	200/6800
R-7315x	19 - 28	15	13 - 17	3	97	96	200/6800
R-743.3x	4.5 - 28	3.3	2.5 - 5.5	4	93	88	200/6800
R-745.0x	6.5 - 28	5.0	3.0 - 5.5	4	95	91	200/6800
R-746.5x	8.5 - 28	6.5	5.0 - 7.5	4	96	93	200/6800

Notes:

Note1: Vin-Vout ≥ 1.5V~4.0V depending on Vout if adjust function is used

Note2: Please refer to basic characteristics on page I-2

Model Numbering



Notes:

Note3: x can be „P“ = vertical through hole

x can be „D“ = bent pins for horizontal through hole mounting

Ordering Examples:

R-723.3P Iout= 2A nom. Vout= 3.3VDC P= vertical through hole
R-7312D Iout= 3A nom. Vout= 12VDC D= horizontal through hole

Specifications (refer to standard application circuit, Ta= 25°C)

BASIC CHARACTERISTICS

Parameter	Condition	Min.	Typ.	Max.
Quiescent Current	min. Vin to max.			30mA
Internal Power Dissipation	ta<60°C			1.4W
Output Current Limit	R-72xxx R-73xxx R-74xxx		2.5A 3.75A 5.0A	3.0A 4.25A 5.5A
Minimum Load ⁽⁴⁾		10%		
ON/OFF CTRL ⁽⁵⁾	DC-DC ON DC-DC OFF	Open or high, 4.5V min. / 28V max. Low (Power OFF) 0.8V max.		
Input Current of CTRL Pin	DC-DC OFF			100µA
Internal Operating Frequency		270kHz	300kHz	330kHz
Output Ripple and Noise			40mVp-p	70mVp-p
Maximum Capacitive Load	normal start-up time, no external diodes			200µF
	<1 second start-up time + diode protection circuit			6800µF

Notes:

Note4: Operation below 10% load won't harm the converter, but specifications may not be met

Note5: ON/OFF pin driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET

How to calculate the max output current

The internal power dissipation (P_D) follows the equation:

$$P_D = I_{out} \times V_{out} \times (1 - \text{Eff}_{\max V_{in}})$$

$$I_{out} = \frac{P_D}{V_{out} \times (1 - \text{Eff}_{\max V_{in}})}$$

Example: R-745.0P

Calculation 1:

$$V_{in} = 28V$$

$$V_{out} = 5V$$

$$\text{Eff}_{\max V_{in}} = 91\%$$

$$P_D = 1.4W$$

$$T_{\text{Ambient}} = 60^\circ\text{C}$$

$$I_{out} = \frac{1.4W}{5V \times (1 - 0.91)} = 3.11A$$

Calculation 2:

$$V_{in} = 28V$$

$$V_{out} = 5V$$

$$\text{Eff}_{\max V_{in}} = 91\%$$

$$P_D = 1.0W$$

$$T_{\text{Ambient}} = 85^\circ\text{C}$$

$$I_{out} = \frac{1W}{5V \times (1 - 0.91)} = 2.222A$$

Calculation 3:

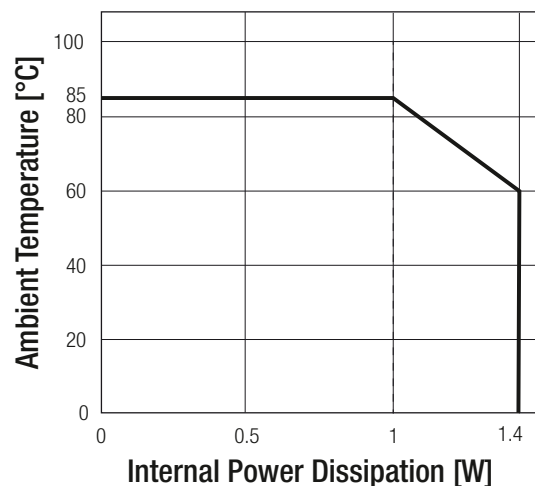
$$V_{in} = 12V$$

$$\text{Eff}_{\max V_{in}} = 94\%$$

$$P_D = 1.0W$$

$$T_{\text{Ambient}} = 85^\circ\text{C}$$

$$I_{out} = \frac{1W}{5V \times (1 - 0.94)} = 3.33A$$

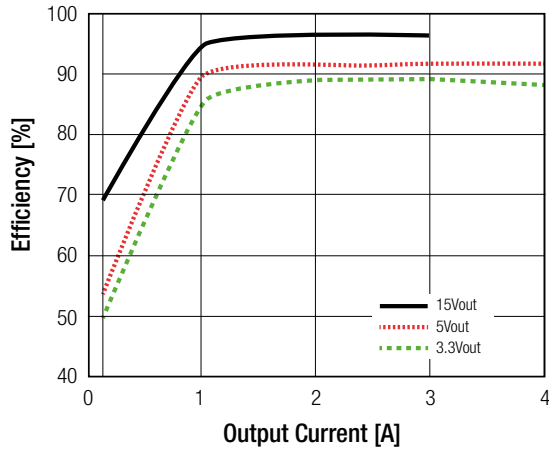


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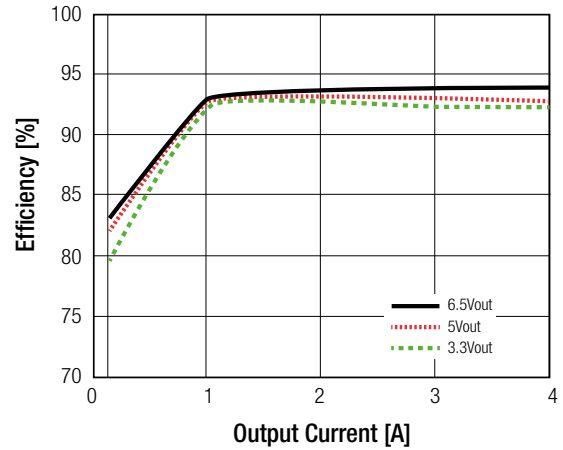
Specifications (refer to standard application circuit, Ta= 25°C)

Efficiency vs. Load

R-72xx / R-73xx / R-74xx
max. Vin

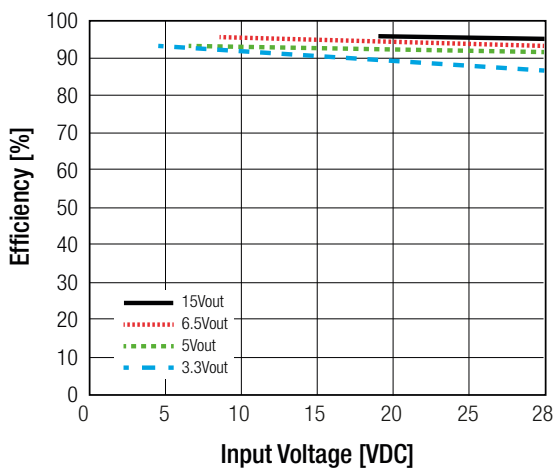


R-72xx / R-73xx / R-74xx
min. Vin

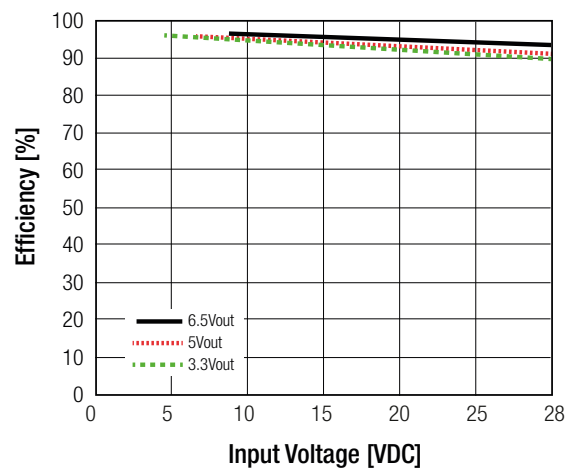


Efficiency vs. Input Voltage

R-72xx / R-73xx

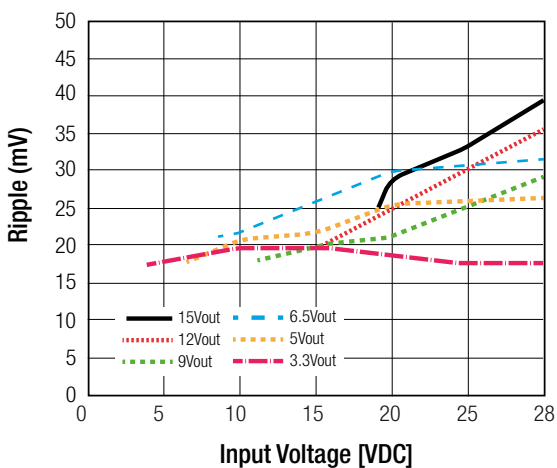


R-74xx

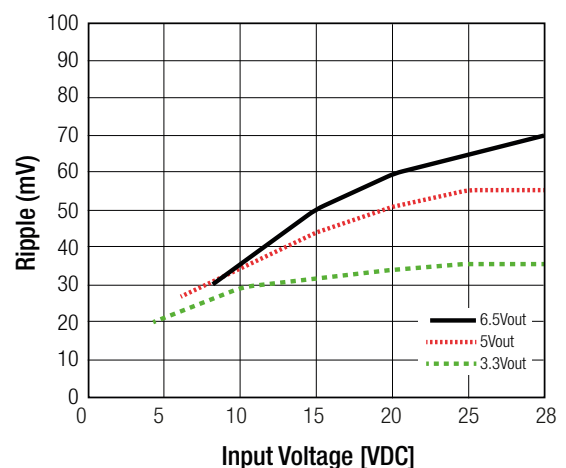


Ripple vs. Input Voltage

R-72xx / R-73xx



R-74xx



Specifications (refer to standard application circuit, Ta= 25°C)

Trim Table

2ADC	R-723.3P/D	R-725.0P/D	R-726.5P/D	R-729.0P/D	R-7212P/D	R-7215P/D
3ADC	R-733.3P/D	R-735.0P/D	R-736.5P/D	R-739.0P/D	R-7312P/D	R-7315P/D
4ADC	R-743.3P/D	R-745.0P/D	R-746.5P/D			

Vout nom.	3.3VDC		5.0VDC		6.5VDC		9.0VDC		12VDC		15VDC	
Vout adj.	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
2.5	8.5kΩ											
3.0	33kΩ		470kΩ									
3.2	110kΩ		1.6kΩ									
3.3			2.2kΩ									
3.4		36kΩ	3.0kΩ									
3.6		11kΩ	4.7kΩ									
3.9		4.7kΩ	8.5kΩ									
4.5		1.6kΩ	30kΩ									
4.9		820Ω	220kΩ									
5.0		680Ω			11kΩ							
5.1		560Ω		28kΩ	12kΩ							
5.5		190Ω		2.6kΩ	20kΩ							
6.0					47kΩ							
6.5												
7.0						4.5kΩ	13kΩ					
7.5						2.2kΩ						
8.0							31kΩ					
9.0												
10								2.2kΩ	20kΩ			
11								390Ω	47kΩ			
12												
13										2.4kΩ	36kΩ	
14										390Ω	76kΩ	
15												
16												2.6kΩ
17												860Ω

REGULATIONS

Parameter	Condition	Value
Output Accuracy	full load	±1.0% typ. / ±2.0% max.
Line Regulation	low line to high line, full load	± 0.5% typ. / ±1.0% max.
Load Regulation	10% to 100%, full load	± 0.5% typ. / ±1.0% max.
Transient Response ⁽⁶⁾	50% load step change Vout Over / Undershoot	100µs typ. / 200µs max. 100mV max.

Notes:

Note6: Requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor has to be placed as close as possible to the output pins)

Specifications (refer to standard application circuit, Ta= 25°C)

PROTECTIONS

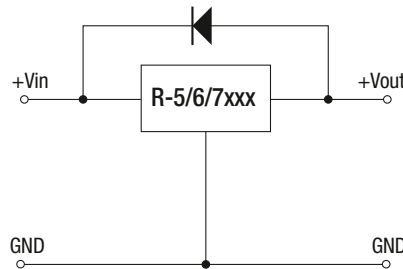
Parameter	Condition	Value
Short Circuit Protection (SCP)		continuous, automatic recovery
Short Circuit Input Current		50mA typ. / 100mA max.

Optional Diode Protection Circuit

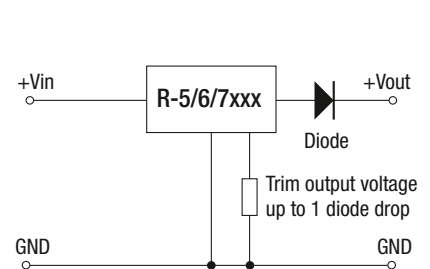
Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter when it is powered down. Protection diodes are required for high capacitive loads.

The diode can either be fitted across the device, if the source is low impedance or fitted in series with the output (recommended).

Optional Protection 1:

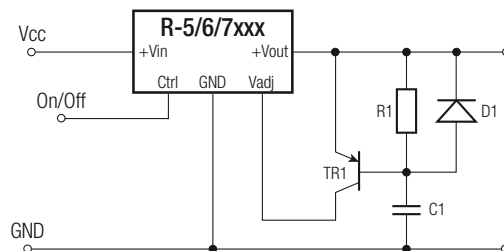


Optional Protection 2:



Output Soft Start

Innoline converters with Vadj pins (R-78Axx-xxSMD, R-5xxx, R-6xxx and R-7xxx families) can be fitted with an external circuit to create an output soft start. Any general purpose PNP transistor and diode can be used for TR1 and D1 and typical values for R1 = 100K and C1 = 10µF.



ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	without derating @ natural convection 0.1m/s		-40°C to +85°C
Maximum Case Temperature			+110°C
Thermal Impedance	@ natural convection 0.1m/s		25°C/W
Operating Humidity	non-condensing		95% RH max.
Operating Altitude			2000m
Pollution Degree			PD2
MTBF	according to MIL-HDBK 217F, G.B.	+25°C	749 x 10 ³ hours
		+85°C	150 x 10 ³ hours

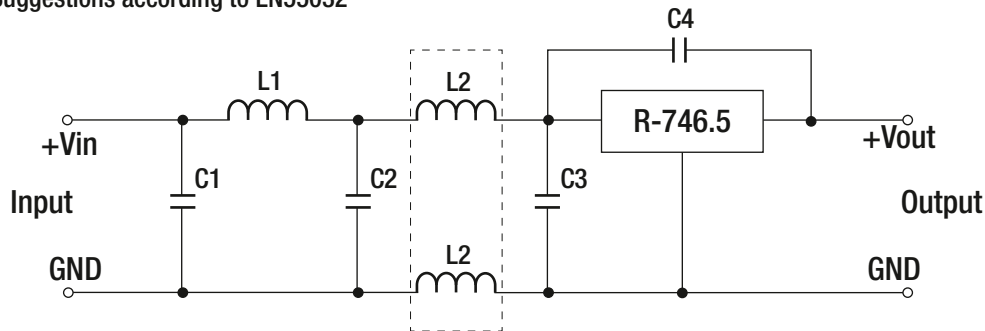
SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report / File Number	Standard
Information Technology Equipment, General Requirements for Safety	1605077-12	IEC60950-1:2005, 2nd Edition + AM2:2013 EN60950-1:2006 + AM2:2013
EAC	RU-AT.49.09571	TP TC 004/2011
RoHS 2+		RoHS-2011/65/EU + AM-2015/863

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Specifications (refer to standard application circuit, Ta= 25°C)

EMC Filtering Suggestions according to EN55032



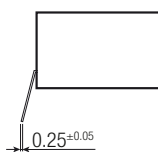
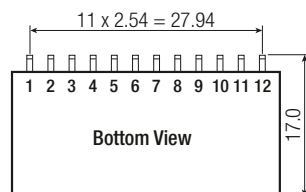
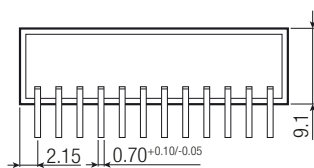
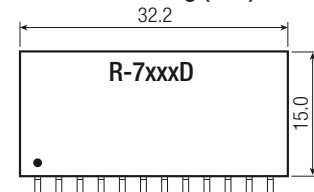
Component List

EN55022	C1	C2	C3	C4	L1	L2
Class A	N/A	33 μ F	N/A	N/A	N/A	0.45mH CMC
Class B	10 μ F	33 μ F	1nF/2kV	2mH	0.45mH CMC	

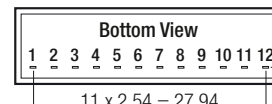
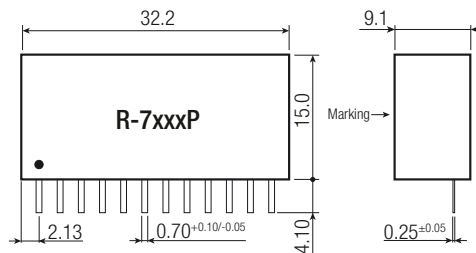
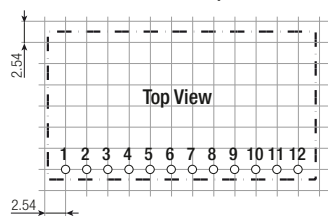
DIMENSION AND PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case potting	non-conductive black plastic, (UL94 V-0) epoxy, (UL94 V-0)
Package Dimension (LxWxH)		32.2 x 9.1 x 15.0mm
Package Weight		9g typ.

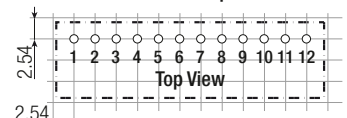
Dimension Drawing (mm)



Recommended Footprint Details



Recommended Footprint Details



Pin Connections

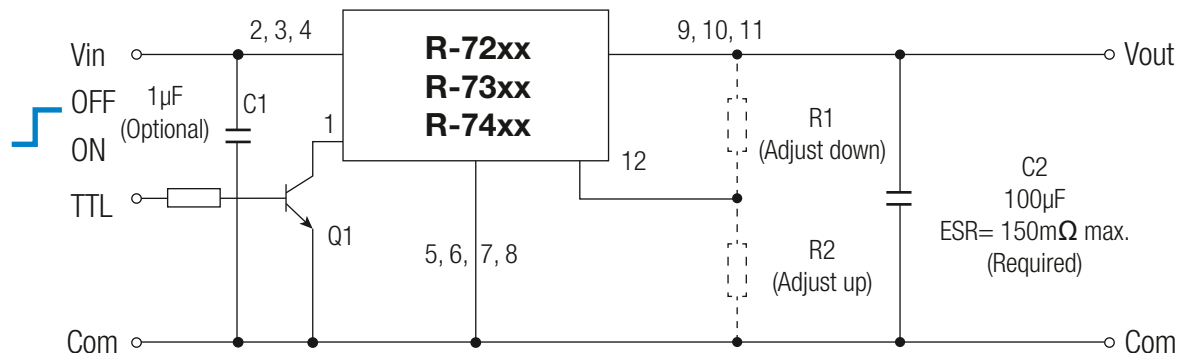
Pin #	Single	Description
1	ON / OFF	Input pin: Active low (less than 0.8V) to disable the device
2,3,4	Vin	Power Input
5, 6, 7, 8	GND	Input and Output ground (common)
9, 10, 11	Vout	Power output
12	Vout-Adj.	with external resistors R1, R2 to selected output voltage

Tolerance:
xx.x= ± 0.5 mm
xx.xx= ± 0.25 mm

Specifications (refer to standard application circuit, Ta= 25°C)

INSTALLATION AND APPLICATION

Standard Application Circuit



Add blocking diode to Vout if current can flow backwards into the output, as this can damage the converter.
(Please refer to "Optional Diode Protection Circuit" on Page I-5)

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimensions (LxWxH)	R-7xxxD	520.0 x 20.0 x 19.0mm
	R-7xxxP	530.0 x 23.0 x 19.0mm
Packaging Quantity	tube	15pcs
Storage Temperature Range		-40°C to +125°C