

## Features

- Non-Isolated
- Synchronous rectification design
- Adjustable Output voltage
- 2, 3, 4AMP Adjustable Positive Step Down Integrated Switching Regulator
- Over load protection (125% full load typical)
- Remote ON/OFF Control(Ground Off)
- Wide Input Range
- UL94V-0 Package Material
- Continuous short circuit protection (Very low short current  $I_{sc} < 50mA$ )
- Input voltage range 4.5V~28V
- Efficiency to 97 %

## Description

The R-7XXX series is a high performance 2.5V to 15V , 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 with crowbar function reduces the short circuit current to under 50mA of input current.

## Selection Guide

| Part Number<br>SIP12 | Input Range<br>(V) | Nominal Output Voltage<br>(V) | Vout Adjust Range<br>(V) | Output Current<br>(A) | Efficiency (%) |     |          |
|----------------------|--------------------|-------------------------------|--------------------------|-----------------------|----------------|-----|----------|
|                      |                    |                               |                          |                       | Min. Vin       | 12V | Max. Vin |
| R-723.3x             | 4.5 – 28           | 3.3                           | 2.5 – 5.5                | 2                     | 95             | 93  | 89       |
| R-725.0x             | 6.5 – 28           | 5.0                           | 3.0 – 5.5                | 2                     | 96             | 95  | 91       |
| R-726.5x             | 8.5 – 28           | 6.5                           | 5.0 – 8.0                | 2                     | 97             | 96  | 93       |
| R-729.0x             | 12 – 28            | 9.0                           | 7.0 – 11                 | 2                     | 96             | -   | 93       |
| R-7212x              | 15 – 28            | 12                            | 10 – 14                  | 2                     | 97             | -   | 95       |
| R-7215x              | 19 – 28            | 15                            | 13 – 17                  | 2                     | 97             | -   | 96       |
| R-733.3x             | 4.5 – 28           | 3.3                           | 2.5 – 5.5                | 3                     | 94             | 93  | 89       |
| R-735.0x             | 6.5 – 28           | 5.0                           | 3.0 – 5.5                | 3                     | 95             | 95  | 92       |
| R-736.5x             | 8.5 – 28           | 6.5                           | 5.0 – 8.0                | 3                     | 97             | 96  | 93       |
| R-739.0x             | 12 – 28            | 9.0                           | 7.0 – 11                 | 3                     | 96             | -   | 94       |
| R-7312x              | 15 – 28            | 12                            | 10 – 14                  | 3                     | 97             | -   | 96       |
| R-7315x              | 19 – 28            | 15                            | 13 – 17                  | 3                     | 97             | -   | 96       |
| R-743.3x             | 4.5 – 28           | 3.3                           | 2.5 – 5.5                | 4                     | 93             | 92  | 88       |
| R-745.0x             | 6.5 – 28           | 5.0                           | 3.0 – 5.5                | 4                     | 95             | 94  | 91       |
| R-746.5x             | 8.5 – 28           | 6.5                           | 5.0 – 7.5                | 4                     | 96             | 96  | 93       |

Note:  $V_{in} - V_{out} \geq 1.5V - 4.0V$  depending on  $V_{out}$  if adjust function is used!

Suffix x: (see mechanical drawing for details)

x = P pins vertical through hole

x = D pins bent for horizontal through hole mounting

**INNOLINE**  
DC/DC-Converter  
with 3 year Warranty

**RECOM**

**2, 3, 4 AMP  
SIP12  
Vertical &  
Horizontal**



**EN-60950-1 Certified**

**R-7xxx**

**Specifications (refer to the standard application circuit, Ta: 25°C)**

| Characteristics                                           | Conditions                                                                                               | Min.                                                           | Typ.               | Max.                             |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------------------|----------------------------------|
| Output Voltage Range                                      | All Series                                                                                               | 2.5                                                            |                    | 17V                              |
| Output Current                                            | R-72xxP/D<br>R-73xxP/D<br>R-74xxP/D                                                                      | 0.2<br>0.3<br>0.4                                              |                    | 2.0A<br>3.0A<br>4.0A             |
| Output Current Limit                                      | R-72xxP/D<br>R-73xxP/D<br>R-74xxP/D                                                                      |                                                                | 2.5<br>3.75<br>5.0 | 3.0A<br>4.25A<br>5.5A            |
| Short Circuit Input Current                               | All Series                                                                                               |                                                                | 50                 | 100mA                            |
| Short Circuit Protection                                  | Continuous, automatic recovery                                                                           |                                                                |                    |                                  |
| Output Voltage Accuracy (At 100% Load)                    | All Series                                                                                               |                                                                | ±1%                | ±2%                              |
| Line Voltage Regulation (Vin = min. to max. at full load) | All Series                                                                                               |                                                                | 0.5                | 1.0%                             |
| Load Regulation (10 to 100% full load)                    | All Series                                                                                               |                                                                | 0.5                | 1.0%                             |
| Ripple & Noise                                            | All Series                                                                                               |                                                                | 40mVp-p            | 70mVp-p                          |
| Transient Response (see note 1)                           | 50% Load Change –<br>Vout Over / Undershoot                                                              |                                                                | 100µs              | 200µs<br>100mV                   |
| Remote ON / OFF (see note 2)                              | Open or High (Power ON)<br>Low (Power OFF)                                                               | 4.5                                                            |                    | 28V<br>0.8V                      |
| Max capacitance Load                                      | with normal start-up time, no external diodes<br>with <1 second start up time + diode protection circuit |                                                                |                    | 200µF<br>6800µF                  |
| Switching Frequency                                       |                                                                                                          | 270                                                            | 300                | 330kHz                           |
| Shutdown current                                          | ON / OFF Pin pulled low                                                                                  |                                                                |                    | 100µA                            |
| Quiescent Current                                         | Vin = min. to max. at 0% load                                                                            |                                                                |                    | 30mA                             |
| Operating Temperature Range                               |                                                                                                          | -40°C                                                          |                    | +85°C                            |
| Operating Case Temperature                                |                                                                                                          |                                                                |                    | +110°C                           |
| Storage Temperature Range                                 |                                                                                                          | -40°C                                                          |                    | +125°C                           |
| Case Material                                             |                                                                                                          |                                                                |                    | Non-Conductive Black Plastic     |
| Potting Material                                          |                                                                                                          |                                                                |                    | Epoxy (UL94V-0)                  |
| Thermal Impedance                                         | Natural Convection                                                                                       |                                                                |                    | 25°C/W                           |
| Internal Power Dissipation                                | Ta < 60°C                                                                                                |                                                                |                    | 1.4W                             |
| Package Weight                                            |                                                                                                          |                                                                |                    | 9g                               |
| Packing Quantity                                          |                                                                                                          |                                                                |                    | 15 pcs per Tube                  |
| MTBF (Nominal Vout, 100% load)                            | Tamb. = +25°C<br>Tamb. = +85°C                                                                           | } Detailed Information see<br>Application Notes chapter "MTBF" |                    | 749 x 10³hours<br>150 x 10³hours |

**Notes:**

- Requires a 100µF electrolytic or tantalum output capacitor for proper operation in all applications (the capacitor to be placed as close as possible to the output pins).
- ON / OFF pin driven by TTL (logic gate), open-collector bipolar transistor or open-drain MOSFET.

## Output Current vs Input Voltage

### How to calculate the max output current

The internal power dissipation(P<sub>D</sub>)follows the equation:

$$P_D = I_o \times V_o \times (1-\eta)$$

$$I_o = P_D / V_o \times (1-\eta)$$

Where P<sub>D</sub> = Internal power dissipation

I<sub>o</sub> = Output current

V<sub>o</sub> = Output voltage

η = Efficiency

Example: R-745.0P, at Vin = 28Vdc, Vo = 5Vdc, η=91% (see "Selection Guide" table)

(a) When Ta = 60°C, P<sub>D</sub> = 1.4 Watt (see beside diagram)

$$I_o = 1.4(W) / 5(V) \times (1-0.91) = 3.11(A)$$

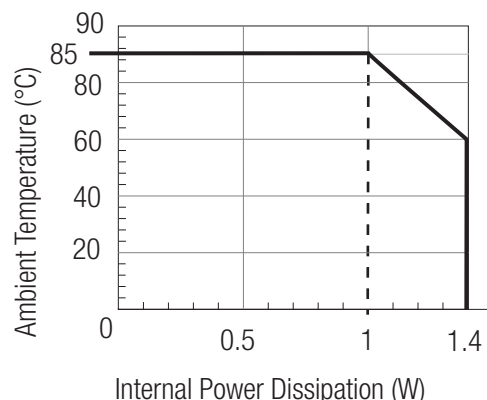
(b) When Ta = 85°C, P<sub>D</sub> = 1 Watt (see beside diagram)

$$I_o = 1(W) / 5(V) \times (1-0.91) = 2.222(A)$$

(c) At Vin = 12Vdc efficiency = 94% (see "Selection Guide" table)

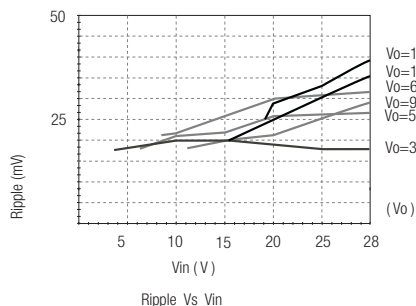
When Ta = 85°C, P<sub>D</sub> = 1 Watt (see beside diagram)

$$I_o = 1(W) / 5(V) \times (1-0.94) = 3.33(A)$$

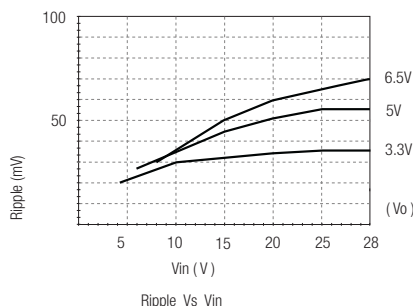


## Characteristics

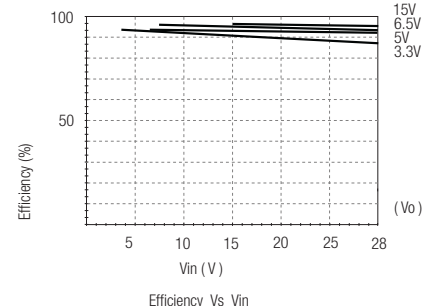
R-72xx / R-73xx  
Ripple VS Vin



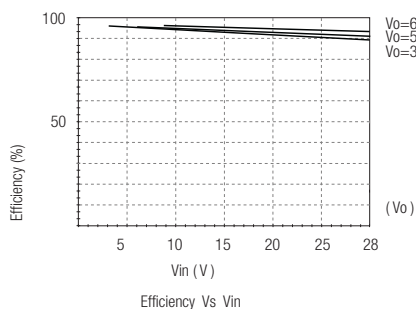
R-74xx  
Ripple VS Vin



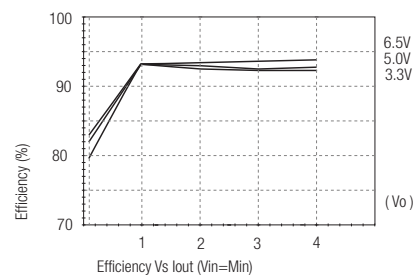
R-72xx / R-73xx  
Efficiency VS Vin



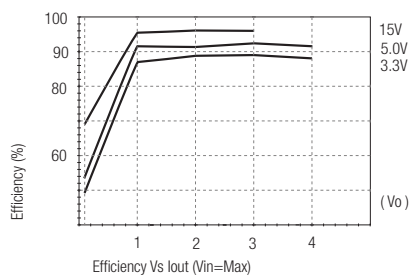
R-74xx  
Efficiency VS Vin



R-72xx / R-73xx / R-74xx  
Efficiency / Load Vin=Min

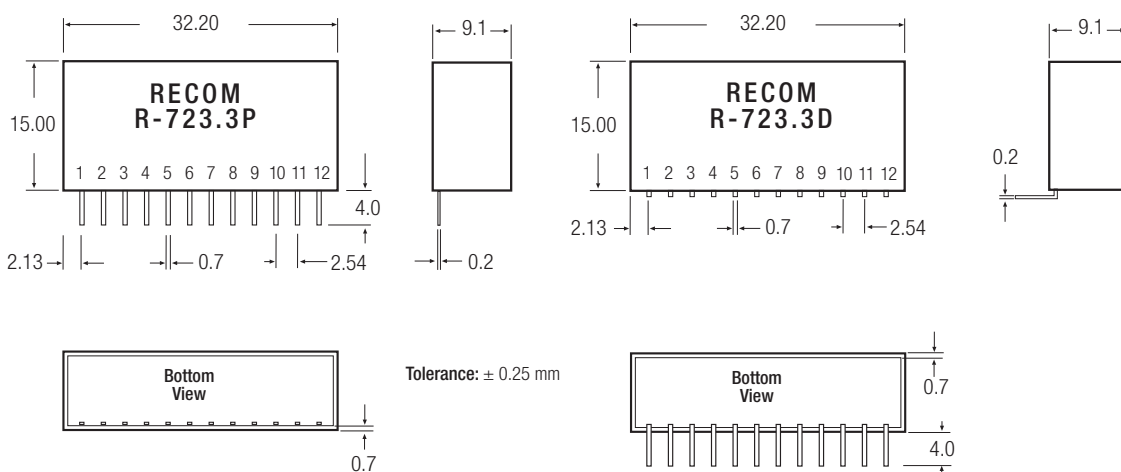


R-72xx / R-73xx / R-74xx  
Efficiency / Load Vin=Max



## Package Style and Pinning (mm)

SIP12 PIN Package



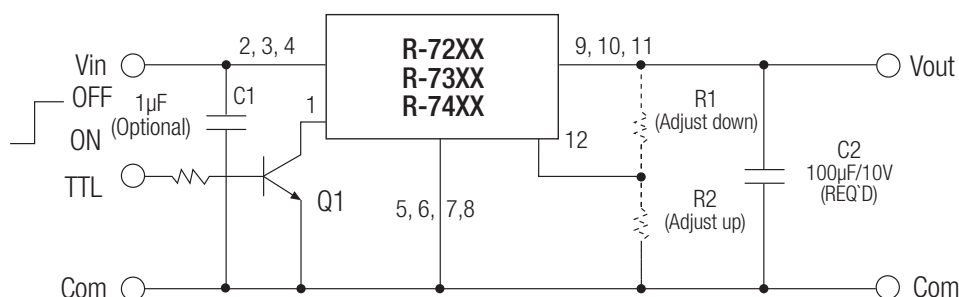
Pin Connections

| Pin #      | Name     | 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      |

**Table 1: Adjustment Resistor Values**

| 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 (nominal) | 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            | 8.5K $\Omega$ |               |               |               |              |              |              |               |              |               |              |               |
| 3.0            | 33K $\Omega$  |               | 470 $\Omega$  |               |              |              |              |               |              |               |              |               |
| 3.2            | 110K $\Omega$ |               | 1.6K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 3.3            |               |               | 2.2K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 3.4            |               | 36K $\Omega$  | 3.0K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 3.6            |               | 11K $\Omega$  | 4.7K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 3.9            |               | 4.7K $\Omega$ | 8.5K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 4.5            |               | 1.6K $\Omega$ | 30K $\Omega$  |               |              |              |              |               |              |               |              |               |
| 4.9            |               | 820 $\Omega$  | 220K $\Omega$ |               |              |              |              |               |              |               |              |               |
| 5.0            |               | 680 $\Omega$  |               |               | 11K $\Omega$ |              |              |               |              |               |              |               |
| 5.1            |               | 560 $\Omega$  |               | 28K $\Omega$  | 12K $\Omega$ |              |              |               |              |               |              |               |
| 5.5            |               | 190 $\Omega$  |               | 2.6K $\Omega$ | 20K $\Omega$ |              |              |               |              |               |              |               |
| 6.0            |               |               |               |               | 47K $\Omega$ |              |              |               |              |               |              |               |
| 6.5            |               |               |               |               |              |              |              |               |              |               |              |               |
| 7.0            |               |               |               |               |              | 560 $\Omega$ | 13K $\Omega$ |               |              |               |              |               |
| 8.0            |               |               |               |               |              | 330 $\Omega$ | 31K $\Omega$ |               |              |               |              |               |
| 9.0            |               |               |               |               |              |              |              |               |              |               |              |               |
| 10             |               |               |               |               |              |              |              | 2.2K $\Omega$ | 20K $\Omega$ |               |              |               |
| 11             |               |               |               |               |              |              |              | 390 $\Omega$  | 47K $\Omega$ |               |              |               |
| 12             |               |               |               |               |              |              |              |               |              |               |              |               |
| 13             |               |               |               |               |              |              |              |               |              | 2.4K $\Omega$ | 36K $\Omega$ |               |
| 14             |               |               |               |               |              |              |              |               |              | 390 $\Omega$  | 76K $\Omega$ |               |
| 15             |               |               |               |               |              |              |              |               |              |               |              |               |
| 16             |               |               |               |               |              |              |              |               |              |               |              | 2.6K $\Omega$ |
| 17             |               |               |               |               |              |              |              |               |              |               |              | 860 $\Omega$  |
| 18             |               |               |               |               |              |              |              |               |              |               |              |               |

## Standard Application Circuit



Add a blocking diode to Vout if current can flow backwards into the output, as this can damage the converter.

Protection diodes are required for high capacitive loads.

Refer to R-5xxxA Datasheet (see Optional Diode Protection Circuit) for circuit suggestions.