



## Features

- ▶ Rated current: 2A Max
- ▶ Non-isolated, step-down switching regulators
- ▶ Input range: 4.5~36VDC
- ▶ Regulated single output
- ▶ High efficiency up to 96%
- ▶ Low ripple and noise
- ▶ Low no load input current, 0.2mA only
- ▶ Operating temperature range: -40 ~ +85°C ambient
- ▶ RoHS compliant
- ▶ Compact SIP3 package
- ▶ Compatible with LM78 linear regulators
- ▶ Continuous short circuit protection
- ▶ Designed to meet: UL/IEC/EN 62368-1
- ▶ 5 year warranty



## Overview

The RM20S series are 2A rated non-isolated switching regulators, pin to pin compatible with LM78 family linear regulators. Unlike those linear regulators, the switching regulators are high efficiency. They do not need for any heatsinks because very little energy is wasted as heat. Besides, these converters accept ultra-wide input range, operate over wide ambient temperature range, and are continuous short circuit protected. These converters are especially suitable for applications where energy saving, space saving and high performance are essential.

## Model Numbers

Model Number	Input Voltage Range [VDC]			V <sub>OUT</sub> [VDC]	I <sub>OUT</sub> [mA] Max.	Efficiency [%] Typ.		Capacitive Load [uF] Max.
	Nominal	Min.	Max.			Min. V <sub>IN</sub>	Max. V <sub>IN</sub>	
RM20S-018	24	4.5	28	1.8	2000	83	79	2000
RM20S-025	24	4.5	36	2.5	2000	89	83	2000
RM20S-033	24	6	36	3.3	2000	89	85	1800
RM20S-050	24	8	36	5.0	2000	92	89	1000
RM20S-065	24	10	36	6.5	2000	92	89	1000
RM20S-090	24	13	36	9.0	2000	95	92	680
RM20S-120	24	16	36	12	2000	96	94	470
RM20S-150	24	18	36	15	2000	96	94	470

\* Only typical models are listed. Contact our sales agent for availability of other models.

\* Add suffix "L" for pins bended to L shape. See Mechanical Specifications for details. E.g. RM20S-033L



## Electrical Specifications

Unless otherwise indicated, specifications are measured at  $T_A=25^\circ\text{C}$ , nominal input voltage, full load after warm up.

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
<b>No load input current</b>	$V_{IN}$ = Min. to Max.	-	0.2	1.0	mA	
<b>Output voltage accuracy</b>	$V_{OUT} = 1.8 \dots 3.3\text{V}$ Others	-	$\pm 2$ $\pm 2$	$\pm 4$ $\pm 3$	%	
<b>Line regulation</b>	$V_{IN}$ = Min. to Max.	-	$\pm 0.4$	$\pm 0.8$	%	
<b>Load regulation</b>	$I_{OUT} = 10\% \sim 100\%$	-	$\pm 0.5$	$\pm 1.5$	%	
<b>Temperature coefficient</b>	$-40^\circ\text{C} \sim +85^\circ\text{C}$	-	-	0.03	$^\circ\text{C}$	
<b>Output ripple and noise*</b>	20MHz bandwidth	-	30	75	mVp-p	
<b>Dynamic load response</b> $I_{OUT} = 25\% \sim 50\% \sim 25\%$ or $50\% \sim 75\% \sim 50\%$ step of $I_{OUT, \text{rated}}$	Peak deviation Peak deviation Recovery time	-	$\pm 80$ $\pm 50$ 0.2	$\pm 150$ $\pm 150$ 1	mV mV mS	$V_{OUT}=1.8, 2.5\text{V}$ $V_{OUT}=\text{Others}$
<b>Output short circuit protection</b>		Continuous, automatic recovery				

\* Ripple and noise is higher at low load, 180mVp-p max while  $I_{OUT} = 0 \sim 20\%$ , and 100mVp-p max while  $I_{OUT} = 20 \sim 100\%$

## General Specifications

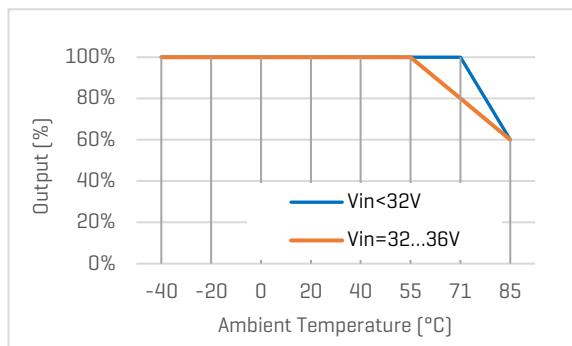
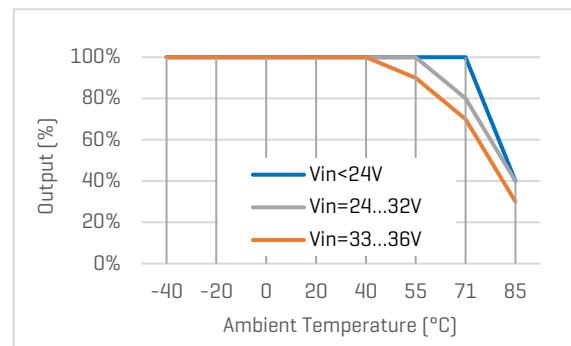
Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
<b>Operating temperature</b>		-40	-	+85	$^\circ\text{C}$	
<b>Storage temperature</b>		-55	-	+125	$^\circ\text{C}$	
<b>Storage humidity</b>	Non-condensing	5	-	95	%RH	
<b>Switching frequency</b>	Full load	-	400	-	KHz	
<b>Pin soldering resistance</b> 1.5mm away from case for 10 sec		-	-	260	$^\circ\text{C}$	
<b>Cooling method</b>		Free air convection				
<b>Case material</b>		Black plastic UL94-VO				
<b>Design based on standards</b>		UL/EN/IEC 62368-1				
<b>Safety certifications</b>		EN/IEC 62368-1				
<b>EMC</b>	Emissions Immunity	CISPR32, EN55032 Class B* [external circuit required] IEC/EN61000-4-2, 3, 4, 6				
<b>MTBF</b>	MIL-HDBK-217F	>2,000,000 Hours, $T_A=25^\circ\text{C}$				
<b>Size &amp; Weight</b>	Standard models Suffix "L" models	11.5 x 9.0 x 17.5 mm, 4g 17.5 x 11.5 x 9.0 mm, 4g				

2.0A, Non-isolated SIP Package Switching Regulators

## Characteristic Curves

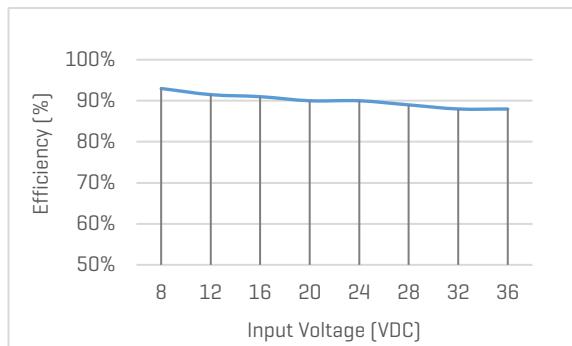
### Derating Curve

#### Output vs Ambient Temperature

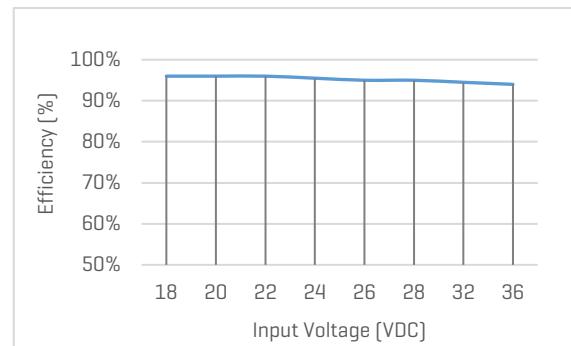
 $V_{OUT} = 1.8 \dots 5V$  $V_{OUT} = 6.5 \dots 15V$ 

### Efficiency vs Input Voltage

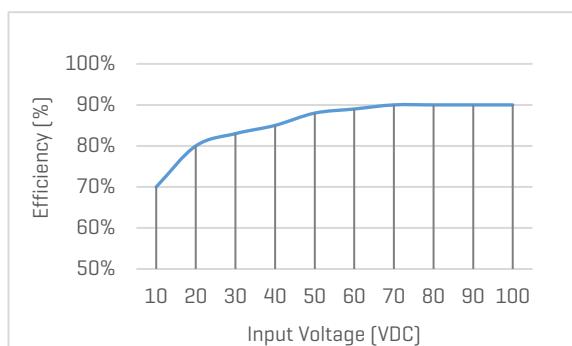
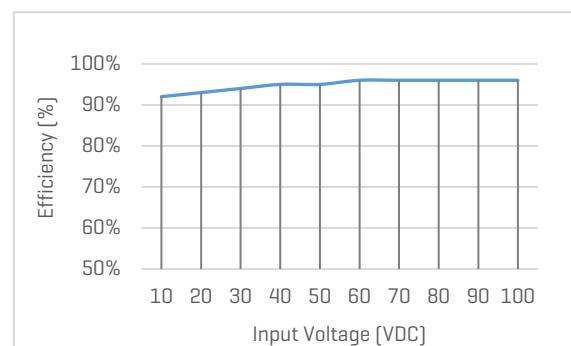
RM20S-050, full load



RM20S-150, full load



### Efficiency vs Load

RM20S-050,  $V_{IN}=24V$ RM20S-150,  $V_{IN}=24V$ 

2.0A, Non-isolated SIP Package Switching Regulators

## Recommended External Circuit

### Typical Application Circuit

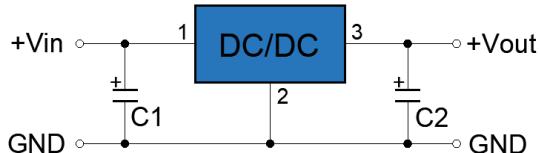


Figure 1: Typical application circuit

### Notes

1. C1, C2 are ceramic capacitors. They are mandatory for the operating of the converter. They can also be tantalum or low ESR electrolytic capacitors. Recommended specs listed in the table on right can be changed according to the needs in the circuits.
2. These converters are not allowed to use in parallel or hot plug without support from properly designed external circuits.

[Table 1] Recommended component specifications

Models	C1	C2
$V_{OUT}=1.8 \dots 6.5V$	22uF, 50V	22uF, 10V
$V_{OUT}=9V$	22uF, 50V	22uF, 16V
$V_{OUT}=12, 15V$	22uF, 50V	22uF, 25V

### Circuit for EMC Enhancement

\* This application circuit is recommended in order to meet EN55032 Class B

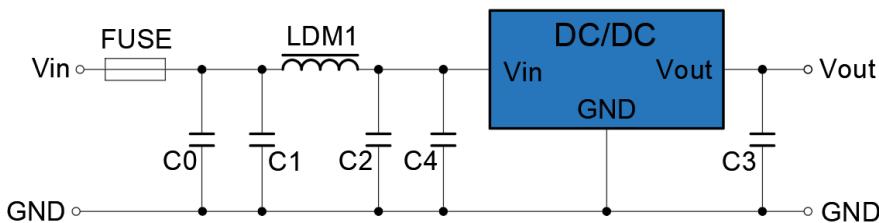


Figure 2. Recommended circuit diagram

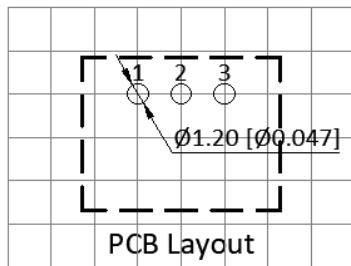
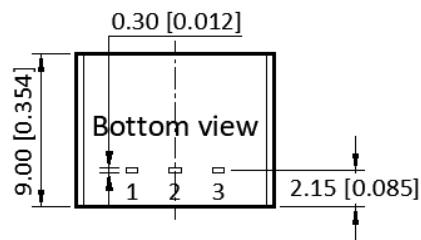
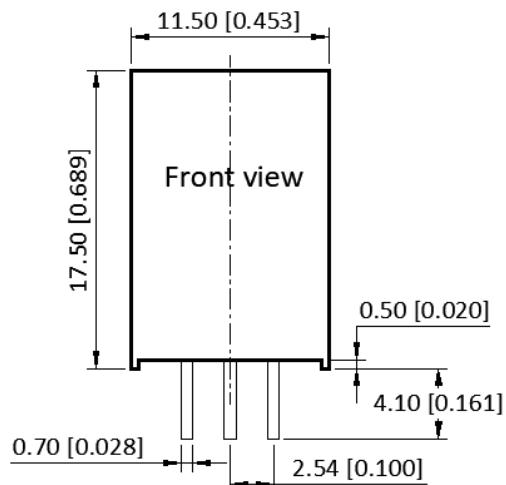
[Table 2] Recommended component spec

Items	LDM1	C0	C1, C2	C3	C4
Spec	22uH	100uF, 100V	10uF, 50V	22uF, 25V	680uF, 50V

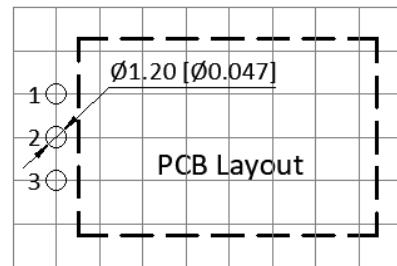
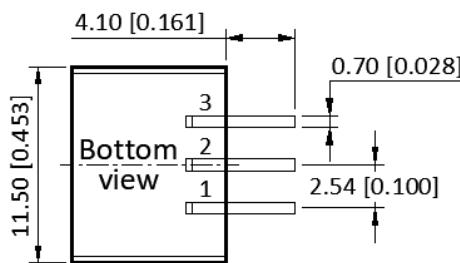
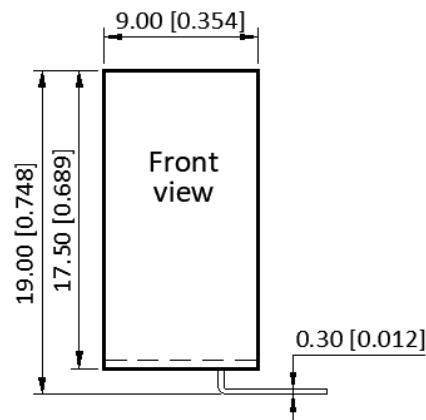


## Mechanical Specifications

Default Package



Suffix "L" Package



### Note

- \* Unless otherwise specified unit: mm [inch]
- \* General tolerance:  $\pm 0.50$  [ $\pm 0.020$ ]
- \* Pin thickness tolerance:  $\pm 0.10$  [ $\pm 0.004$ ]
- \* Footprint grid: 2.54 x 2.54 mm

### Pin Definition

Pin #	Single Out
1	+V <sub>IN</sub>
2	GND
3	+V <sub>OUT</sub>