

Features

Power Module

- 36V 3A SMD Power Module
- High power density in 12.2x12.2x3.75mm case
- -40°C to +100°C with derating, convection cooled
- Efficiency up to 94%
- 6-sided shielding
- Thermally enhanced 25 pad LGA package (DOSA conform)

Description

The RPMB-3.0 series is a 3A non-isolated SMD switching regulator power module with up to 36V input voltage. Despite its compact LGA footprint and low profile (12.2x12.2x3.75mm), it offers a full set of features including adjustable output from 1V up to 24V, on/off control, sense and power good output signals. With an efficiency of up to 94% which remains nearly constant over a 5% to 100% load range, the device can operate at ambient temperatures as high as +100°C without forced air cooling. The package is complete with 6-sided shielding for optimal EMC performance and excellent heat management. The fully protected module (UVLO, SCP, OCP, OTP) can drive high capacitive loads of up to 0.2F.

Selection Guide

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Vout Adjust Range [VDC]	Output Current max. [A]	Efficiency typ. [%]	Max Capacitive typ. Load ⁽¹⁾ [μF]
RPMB3.3-3.0	4-36	3.3	1-9	3.0	84	200000
RPMB5.0-3.0	5.5-36	5	1-9	3.0	88	200000
RPMB12-3.0	12.8-36	12	9-24	3.0	93	15000
RPMB15-3.0	16-36	15	9-24	3.0	94	12000

Notes:

Note1: Max. Capacitive Load is tested at nominal input, nominal output, and full resistive load, below 1 second start-up

Model Numbering



Notes:

Note2: Add suffix "-CT" for tube packaging; for more details refer to "**PACKAGING INFORMATION**" without suffix, standard tape and reel packaging

Specifications (@ Ta= 25°C, nom. Vin, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

BASIC CHARACTERISTICS				
Parameter	Condition		Min.	Typ.
Internal Input Filter			capacitor	
Input Voltage Range ⁽⁴⁾	3.3Vout 5.0Vout 12Vout 15Vout		4VDC 5.5VDC 12.8VDC 16VDC	24VDC (nominal) 36VDC
Absolute Maximum Input Voltage				38VDC
Input Current	nom. Vin= 24VDC	3.3Vout 5.0Vout 12Vout 15Vout	0.5A 0.7A 1.6A 2A	

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RECOM
DC/DC Converter

RPMB-3.0

3 Amp Single Output



EN55032 compliant



www.recom-power.com/eval-ref-boards

Notes:

Note3: 4.7μF/50V/X7R input cap required

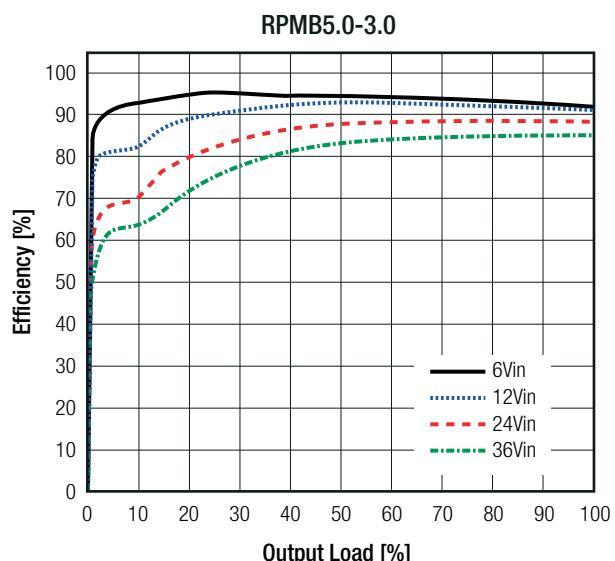
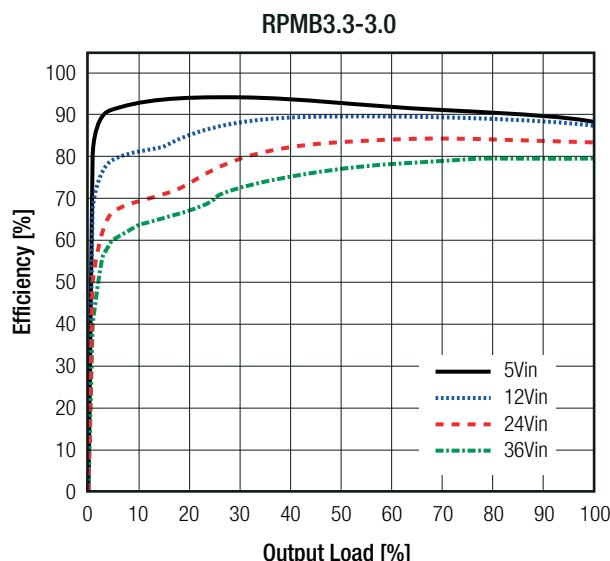
Specifications (@ $T_a = 25^\circ\text{C}$, nom. $V_{in} = 24\text{VDC}$, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

Parameter	Condition	Min.	Typ.	Max.
Quiescent Current	nom. $V_{in} = 24\text{VDC}$	3.3Vout 5.0Vout 12Vout 15Vout	30 μA 36 μA 70 μA 140 μA	
Internal Power Dissipation	nom. $V_{in} = 24\text{VDC}$	3.3Vout 5.0Vout 12Vout 15Vout	1.9W 2W 2.7W 2.9W	
Output Voltage Trimming	refer to " OUTPUT VOLTAGE TRIMMING "	3.3, 5.0Vout 12, 15Vout	1VDC 9VDC	9VDC 24VDC
Minimum Load			0%	
Start-up Time	power up using CTRL function		4.8ms 3.8ms	
Rise-time			900 μs	
ON/OFF CTRL	DC-DC ON DC-DC OFF		Open or $1.26\text{VDC} < V_{CTRL} < V_{in}$ Short to GND or $-0.3\text{VDC} < V_{CTRL} < 0.3\text{VDC}$	
Input Current of CTRL Pin	DC-DC OFF		25 μA	
Standby Current	DC-DC OFF		35 μA	
Internal Operating Frequency	for all types		1.4MHz	
Output Ripple and Noise ⁽⁵⁾	20MHz BW	3.3Vout 5.0Vout 12Vout 15Vout	20mVp-p 25mVp-p 40mVp-p 50mVp-p	50mVp-p 60mVp-p 90mVp-p 100mVp-p

Notes:

Note4: Below minimum input voltage range, the module enters 98% duty cycle mode. Output voltage will not meet the output accuracy specification
 Note5: Measurements are made with a 22 μF MLCC across output (low ESR)

Efficiency vs. Load

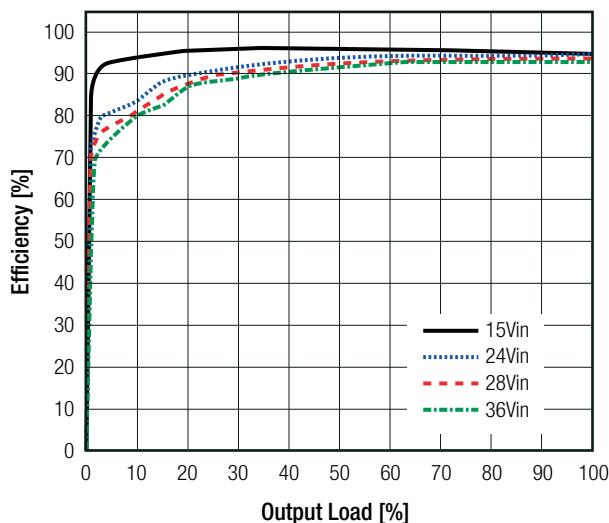


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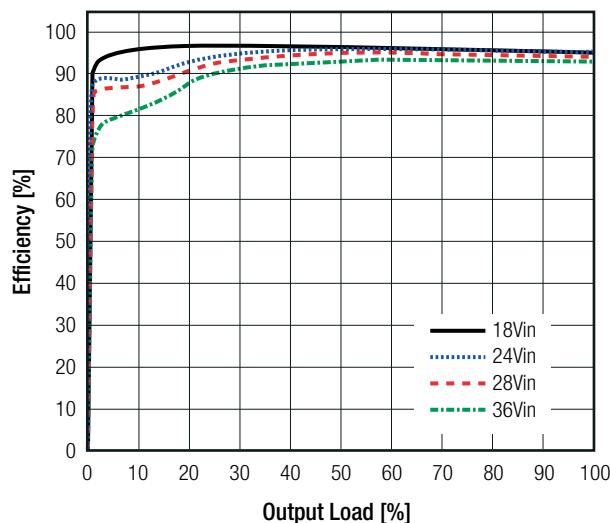
Specifications (@ Ta= 25°C, nom. Vin= 24VDC, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

Efficiency vs. Load

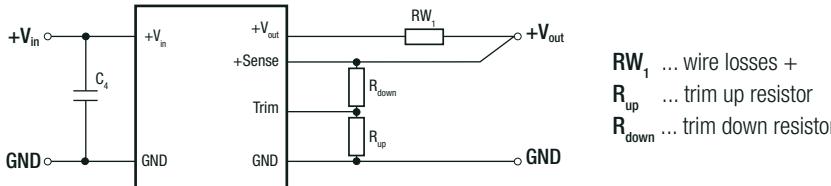
RPMB12-3.0



RPMB15-3.0



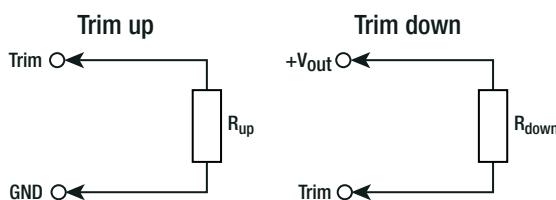
REMOTE SENSE



The output voltage can be adjusted via trim and sense functions. The maximum output voltage from trim and sense functions combined is 9V and 24V (based on models). Power or thermal derating may be required when using trim and/or sense functions.

OUTPUT VOLTAGE TRIMMING

The RPMB-series offers the feature of trimming the output voltage by using external trim resistors. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary. Refer to "**Selection Guide**" for applicable Vout Adjust Range.



V_{out_nom} = nominal output voltage [VDC]
 V_{out_set} = trimmed output voltage [VDC]
 R_{up} = trim up resistor [Ω]
 R_{down} = trim down resistor [Ω]
 R_3, R_4 = internal resistors [Ω]

V_{out_nom}	R_3	R_4
3.3VDC	100k Ω	43.2k Ω
5VDC	100k Ω	24.9k Ω
12VDC	100k Ω	9.09k Ω
15VDC	90.9k Ω	6.49k Ω

Calculation:

$$R_{up} = \frac{R_4 \times (V_{out_set} - 1) - R_3 \times (R_4 + 1)}{R_3 - R_4 \times (V_{out_set} - 1)}$$

$$R_{down} = \frac{R_4 \times (V_{out_set} - 1) \times (R_3 + 1) - R_3}{R_3 - R_4 \times (V_{out_set} - 1)}$$

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Specifications (@ Ta= 25°C, nom. Vin= 24VDC, full load, with input cap⁽³⁾, after warm-up unless otherwise stated)

Practical Example RPMB12-3.0

Vout_{set} = 15VDC

$$R_{up} = \frac{9.09 \times (15 - 1) - 100 \times (9.09 + 1)}{100 - 9.09 \times (15 - 1)}$$

R_{up} according to E96 ≈ 32k4Ω

RPMB3.3-3.0

Trim up

Vout _{set} =	5	[VDC]
R _{up} (E96) ≈	57k6	[Ω]

Trim down

Vout _{set} =	2.5	1.8	1.5	1.2	1.1	[VDC]
R _{down} (E96) ≈	182k	52k3	26k7	8k45	3k48	[Ω]

RPMB5.0-3.0

Trim up

Vout _{set} =	5.5	9	[VDC]
R _{up} (E96) ≈	205k	23k7	[Ω]

Trim down

Vout _{set} =	3.3	2.5	[VDC]
R _{down} (E96) ≈	133k	59k	[Ω]

Practical Example RPMB12-3.0

Vout_{set} = 9VDC

$$R_{down} = \frac{9.09 \times (9 - 1) \times (100 + 1) - 100}{100 - 9.09 \times (9 - 1)}$$

R_{down} according to E96 ≈ 267kΩ

RPMB12-3.0

Trim up

Vout _{set} =	15	24	[VDC]
R _{up} (E96) ≈	32k4	7k32	[Ω]

Trim down

Vout _{set} =	10	9	[VDC]
R _{down} (E96) ≈	453k	267k	[Ω]

RPMB15-3.0

Trim up

Vout _{set} =	20	24	[VDC]
R _{up} (E96) ≈	16k9	9k09	[Ω]

Trim down

Vout _{set} =	12	9.99	[VDC]
R _{down} (E96) ≈	332k	162k	[Ω]

REGULATIONS

Parameter	Condition	Value
Output Accuracy		±1.0% typ. / ±3.0% max.
Line Regulation	low line to high line, full load	±0.25% typ. / ±0.5% max.
Load Regulation	10% to 100% load	0.05% typ.
Transient Response	25% load step change recovery time	200mV 100µs

PROTECTIONS

Parameter	Condition	Value
Short Circuit Protection (SCP)	less than 50mΩ	hiccup mode, automatic recovery
Over Current Protection (OCP)		120% min.
Over Temperature Protection (OTP)	case temperature (measured on tc point)	105°C min., auto restart after cool down 100°C typ.
	DC-DC OFF DC-DC ON	

ENVIRONMENTAL

Parameter	Condition	Value
Operating Temperature Range ⁽⁶⁾	@ natural convection 0.1m/s with derating (refer to "Derating Graph")	-40°C to +100°C
Maximum Case Temperature	measured on tc point (refer to "Dimension Drawing")	+105°C
Temperature Coefficient		0.02%/K
Thermal Impedance ⁽⁶⁾	0.1m/s, horizontal (T _{case} to T _{AMB})	12K/W
Operating Altitude ⁽⁷⁾	with derating @ natural convection 0.1m/s	5000m
Operating Humidity	non-condensing	5% - 95% RH

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Specifications (@ $T_a = 25^\circ\text{C}$, nom. $V_{in} = 24\text{VDC}$, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

Parameter	Condition	Value	
Shock	MIL-STD-810G, Method 516.6, Procedure I	40g, 11ms, saw-tooth, 3 shocks \pm per axis 3 axis; unit is operating	
	MIL-STD-810G, Method 516.6, Procedure IV	drop on 50mm plywood on concrete 26 times from 1 meter	
Random Vibration	MIL-STD-810G, Method 514.6, Procedure I, Category 24	Category 24 - Figure 514.6E-1 - power spectral density = $0.04\text{g}^2/\text{Hz}$ at 20Hz – 1000Hz; -6dB/octave at 1000Hz – 2000Hz; 60 minutes x 3 axis; unit is operating during tests	
MTBF	according to MIL-HDBK-217F, G.B. @ full load	$+25^\circ\text{C}$ max. T_{AMB}	1761×10^3 hours 984×10^3 hours

Notes:

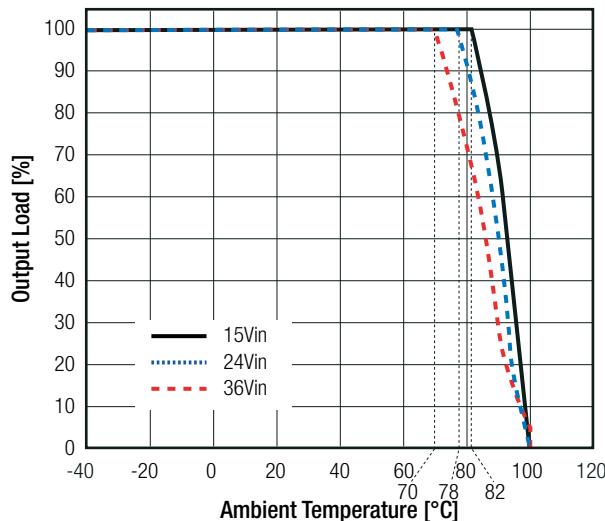
Note6: Tested with a eurocard 160x100mm 70 μm copper, 4 layer

Note7: At altitudes above 2000m, derate output power by 5%/1000m

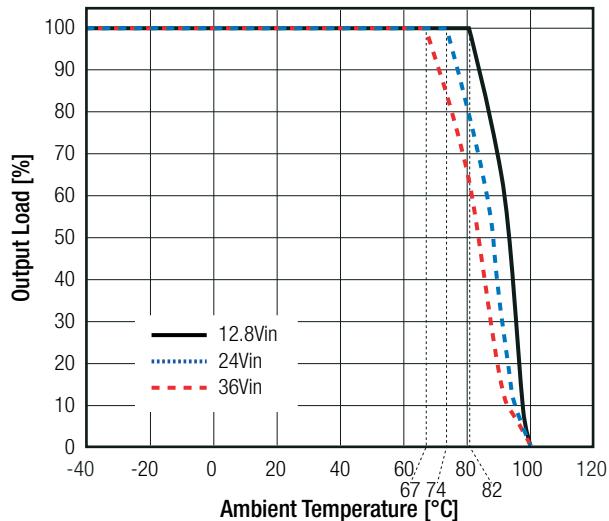
Derating Graph ⁽⁶⁾

(@ chamber and natural convection 0.1m/s, @24Vin)

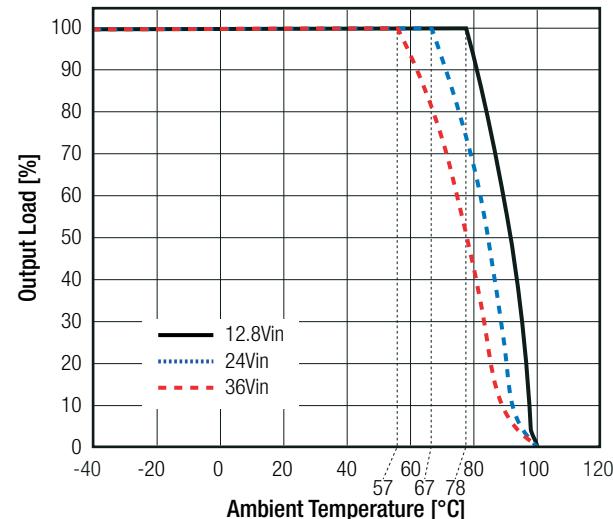
RPMB3.3-3.0



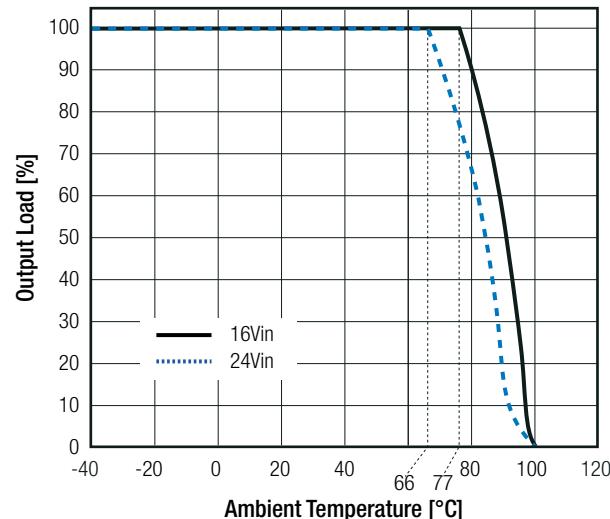
RPMB5.0-3.0



RPMB12-3.0



RPMB15-3.0



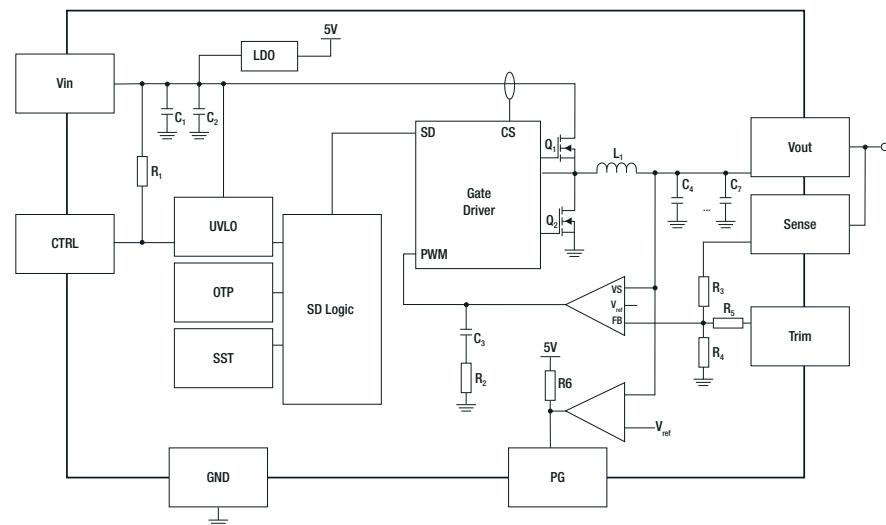
Specifications (@ Ta= 25°C, nom. Vin= 24VDC, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

SAFETY AND CERTIFICATIONS		
Certificate Type (Safety)	Report / File Number	Standard
RoHS2		RoHS 2011/65/EU + AM2015/863
EMC Compliance		
Electromagnetic compatibility of multimedia equipment - emission requirements ⁽⁸⁾	with external components (see filter suggestions below)	EN55032, Class B
EMC filtering suggestion according to EN55032		
Component List Class B		
C1, C2, C3, C4	L1	C5
10µF 50V X7R, 1210	2.2µH shielded inductor	10µF 25V X7R, 1206
Notes:		
Note8: 4.7µF input capacitor (Note3) is not required if using EMC filter suggestion		

DIMENSION AND PHYSICAL CHARACTERISTICS		
Parameter	Type	Value
Material	case PCB solder pads	metal FR4, (UL94 V-0) copper with electrolytic nickel-gold
Dimension (LxWxH)		12.19 x 12.19 x 3.75mm
Weight:		1.1g typ.
Dimension Drawing (mm)		
Pinning information		
A1, A2	Vin	Positive input voltage with respect to GND. Connect to a Vin plane for enhanced thermal performance
C1	CTRL	Active High: pull to GND to disable the device. Pull high or leave open to enable the device
A5, B5	Vout	Positive output voltage. Connect to a Vout plane for enhanced thermal performance
C5	Sense	Connect this pad to the load or directly to Vout. This pad must not be left floating
E5	Trim	Used to set the output voltage between 1V and 24V, leave open if not used
E2	NC	Not connected, leave open or connect to GND
E1	NC	Not connected, leave open or connect to GND
Bottom View		
Top View		
Recommended Footprint Details		
tc = case temperature measuring point Pad tolerance = ±0.05mm Case tolerance = ±0.25mm		

Specifications (@ $T_a = 25^\circ\text{C}$, nom. $V_{in} = 24\text{VDC}$, full load, with input cap ⁽³⁾, after warm-up unless otherwise stated)

BLOCKDIAGRAM



Component List

$V_{out_{nom}}$	R_3	R_4	R_5
3.3VDC	100k Ω	43.2k Ω	1k Ω
5VDC		24.9k Ω	
12VDC		9.09k Ω	
15VDC		90.9k Ω	

$V_{out_{nom}}$	L_1	C_1, C_2	C_4-C_7
3.3VDC	2.2 μH	1 μF , in parallel	10 μF , in parallel
5VDC			
12VDC			
15VDC			

PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	tape and reel	330.2 x 330.2 x 30.4mm
	tape and reel (carton)	365.0 x 365.0 x 55.0mm
	tube (" -CT")	530.0 x 30.3 x 19.2mm
Packaging Quantity	tape and reel	500pcs
	tube (" -CT")	30pcs
Tape Width		24mm
Storage Temperature Range		-55°C to +125°C
Storage Humidity	non-condensing	95% RH max.

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