RICOH

RP504x Series

600mA* PWM/VFM Step-down DC/DC Converter with Synchronous Rectifier

The RP504x Series are low supply current CMOS-based PWM/VFM step-down DC/DC converters with synchronous rectifier. RP504K/L can be switched from two control types by inputting signal to the MODE pin - forced PWM control or PWM/VFM auto switching control in which mode automatically switches to high-efficiency VFM mode in low output current. (RP504N Series can be selected from forced PWM control or PWM/VFM auto switching control.) RP504x includes a soft start circuit, an under-voltage lockout circuit (UVLO), and a latch protection circuit. By simply using an inductor and capacitors as external components, a high-efficiency step-down DC/DC converter can be easily configured. The small inductor (2.2µH) and output capacitor (4.7µH) can be used by the switching of 2.25MHz. In addition to SOT-23-5 and DFN1616-6B packages, a 1.2mm × 1.6mm DFN(PLP)1216-6F package is also available.

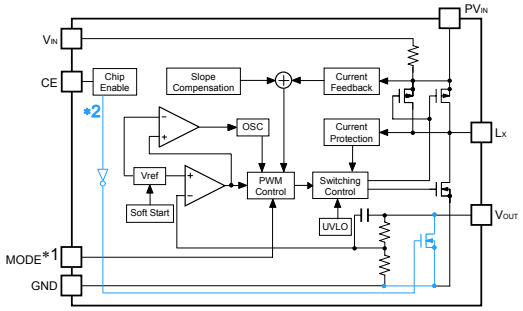
FEATURES

- Supply Current (I_{DD1}) ····· Typ. 400µA (Switching)
- Supply Current (I_{DD2}) ····· Typ. 25µA (No switching, VFM)
- Supply Current (I_{DD2}) ····· Typ. 400µA (No switching, PWM)
- Standby Current ($I_{standby}$) ····· Typ. 0µA (CE="L")
- Input Voltage Range (V_{IN}) ····· 2.3V to 5.5V (V_{SET}≥1.0V, Absolute maximum rating : 6.5V)
- Output Voltage Range (V_{OUT}) ····· 0.8V to 3.3V (Internally fixed)
- Output Voltage Accuracy ····· ± 1.5%
- Output Current (I_{OUT}) ····· 600mA*
- Oscillator Frequency (f_{osc}) ····· 2.25MHz
- Oscillator Maximum Duty Cycle (Maxduty) ·· Min. 100%
- UVLO Detect Voltage (V_{UVLO}) ····· Typ. 2.0V
- Soft Start Time (t_{start}) ····· Typ. 0.15ms
- Coil-current Limit Circuit ····· Current limit Typ. 900mA
- Latch Protection Circuit ····· Delay time for protection Typ. 1.5ms
- Auto-discharge Function ····· D Version
- MODE pin ····· "H": forced PWM control
  "L": PWM/VFM auto switching control
  (RP504N does not have MODE pin)
- Packages ····· DFN(PLP)1216-6F,
  DFN1616-6B, SOT-23-5

*) This is an approximate value, because output current depending on conditions and external parts.

BLOCK DIAGRAM

RP504x

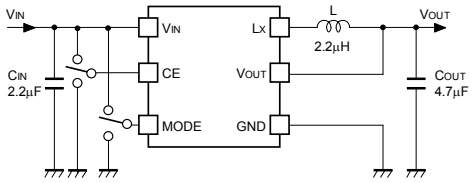


*1) MODE pin exists in RP504K and RP504L only. MODE="H": forced PWM control, MODE="L": PWM/VFM auto switching control.

*2) only D Version.

TYPICAL APPLICATION

RP504L/K



L : MIPSZ2520D2R2, MIPS2520D2R2 (FDK), MLP2520S2R2M, VLS252010T-2R2M (TDK)
CIN : 2.2µF: C1608JB0J225K (TDK), 2.2µF×2: C1005JB0J225K (TDK), JMK105BJ225MV (TAIYO YUDEN) 4.7µF: C1005X5R0J475M (TDK), JMK105BJ475MV (TAIYO YUDEN)
COUT : C1608JB0J475K (TDK), GRM155B30J475KE18 (MURATA)

SELECTION GUIDES

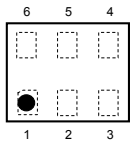
Halogen Free	Package	Q'ty per Reel	Part No.
H/F	DFN(PLP)1216-6F	5,000 pcs	RP504Kxx1*-E2
H/F	DFN1616-6B	5,000 pcs	RP504Lxx1*-TR
H/F	SOT-23-5	3,000 pcs	RP504Nxx1$-TR-FE

xx : Specify the output voltage within the range of 0.8V (08) to 3.3V (33) in 0.1V steps.

* : Select from (A) with MODE pin, without auto-discharge function.
(D) with MODE pin, with auto-discharge function,
$: Select from (B) PWM/VFM auto switching control, without auto-discharge function,
(C) forced PWM control, without auto-discharge function.

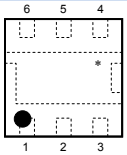
PACKAGES (Top View)

DFN(PLP)1216-6F



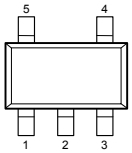
1	VIN
2	MODE
3	CE
4	VOUT
5	GND
6	LX

DFN1616-6B



1	CE
2	MODE
3	VIN
4	LX
5	GND
6	VOUT

SOT-23-5

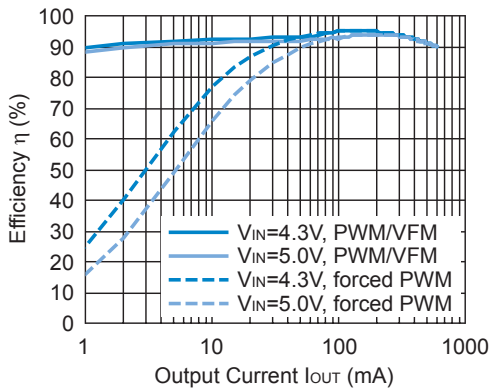


1	VOUT
2	GND
3	LX
4	VIN
5	CE

*) The tab is substrate level (GND).

TYPICAL CHARACTERISTIC

RP504x331x Efficiency vs. Output Current



APPLICATIONS

- Power source for battery-powered equipment
- Power source for hand-held communication equipment, cameras, and VCRs
- Power source for compact HDD

600mA* PWM/VFM Step-down DC/DC Converter with Synchronous Rectifier

RP50x Series 600mA
Step-down DC/DC Converter Comparison

	RP504x Series	RP500x Series	RP502x Series	RP503x Series
Control	PWM/VFM auto switching / Forced PWM (It can be switched by MODE pin)	PWM/VFM auto switching / Fixed PWM	PWM/VFM auto switching / Fixed PWM	PWM/VFM auto switching
Output Current *1	600mA	600mA	600mA	600mA
Supply Current (PWM Mode)	Typ. 400μA	Typ. 400μA	Typ. 750μA	-
Supply Current (VFM Mode)	Typ. 25μA	Typ. 100μA	Typ. 180μA	Typ. 20μA
Supply Current (Standby)	Max. 5μA	Max. 5μA	Max. 5μA	Max. 5μA
Input Voltage Range	2.3V to 5.5V	2.55V to 5.5V	2.5V to 5.5V	2.5V to 5.5V
Output Voltage Range	0.8V to 3.3V	1.1V to 3.3V	0.8V to 3.3V	0.8V to 2.5V
Oscillator Frequency	Typ. 2.25MHz	Typ. 1.2MHz	Typ. 3.3MHz	Typ. 2MHz
Output Voltage Accuracy	±1.5%	±1.5%	±1.5%	±1.5%
Oscillator Maximum Duty Cycle	Min.100%	Min.100%	Min.100%	Min.100%
UVLO Detect Voltage	Typ. 2.0V	Typ. 2.2V	Typ. 2.2V	Typ. 2.2V
Soft-start Time	Typ. 0.15ms	Typ. 0.12ms	Typ. 0.12ms	Typ. 0.15ms
Latch Protection Circuit (Protection Delay Time)	Typ. 1.5ms	Typ. 1.5ms	Typ. 1.5ms	Typ. 1.5ms
Coil-current Limit Circuit	Typ. 900mA	Typ. 900mA	Typ. 900mA	Typ. 800mA
Package	DFN(PLP)1212-6F DFN1616-6B SOT-23-5*3	DFN1616-6*2 DFN(PLP)1820-6 SOT-23-6W	WLCSP-6-P2 DFN1616-6*2	DFN1616-6*2 SOT-23-5*3
Version	DFN Package A Version With MODE pin、without auto-discharge function D Version With MODE pin、with auto-discharge function SOT Package B Version PWM/VFM auto switching, without auto-discharge function C Version Fixed PWM、without auto-discharge function	1 Version PWM/VFM auto switching, without auto-discharge function 2 Version Fixed PWM、without auto-discharge function 3 Version PWM/VFM auto switching, with auto-discharge function (except for the DFN package) 4 Version Fixed PWM、with auto-discharge function	1 Version PWM/VFM auto switching, without auto-discharge function 2 Version Fixed PWM、without auto-discharge function 3 Version PWM/VFM auto switching, with auto-discharge function 4 Version Fixed PWM、with auto-discharge function	1 Version PWM/VFM auto switching, without auto-discharge function 2 Version PWM/VFM auto switching, with auto-discharge function

*1) This is an approximate value, because output current depending on conditions and external parts.
*2) RP500L, RP502L, and RP503L are pin-compatible *3) RP503N and RP504N are pin-compatible

RoHS Compliant
Halogen Free

Ricoh is committed to reducing the environmental loading materials in electrical devices with a view to contributing to the protection of human health and the environment.
Ricoh has been providing RoHS compliant products since April 1, 2006 and Halogen-free products since April 1, 2012.

RICOH ELECTRONIC DEVICES CO., LTD.

http://www.e-devices.ricoh.co.jp/en/

RICOH ELECTRONIC DEVICES CO., LTD.
Higashi-Shinagawa Office (International Sales)
3-32-3, Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-8655, Japan
Phone: +81-3-5479-2857 Fax: +81-3-5479-0502