

RF5RD301/501

STEP-UP/STEP-DOWN DC/DC CONVERTER

RF5RD301/501 are compact DC/DC converter ICs developed with the CMOS process technology. When the input voltage is sufficiently high, they work as series regulators. When the input voltage falls down, they work as step-up switching regulators.

They consist of a step-up switching regulator circuit and series regulator circuit. The switching regulator circuit consists of the reference voltage source, error amplifier, control transistor, oscillation circuit, and output voltage setting resistor. The series regulator circuit consists of the reference voltage source (shared with the switching regulator circuit), error amplifier, output transistor, and output voltage setting resistor.

As external parts, a coil, a diode, and a capacitor are available for making the output voltage constant even when the input voltage changes across the output voltage.

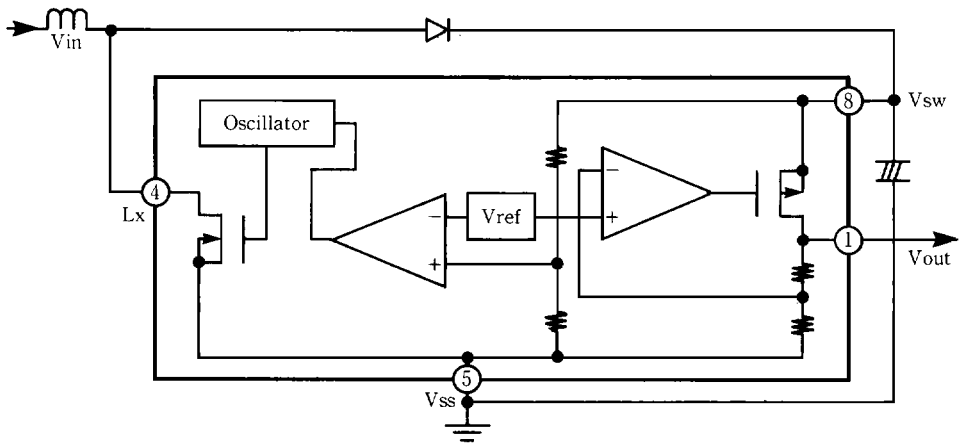
■ Features

- RF5RD301 Output voltage 3V (Typ.)
- RF5RD501 Output voltage 5V (Typ.)
- Low invalid current 4.0 μ A (Typ., no step up, RF5RD301)
- Small invalid current Input voltage $V_{in} \geq 1.2V$ (no load)
- High efficiency 70% (Typ., step up)
- High output voltage accuracy $\pm 5\%$
- Small temperature drift of output voltage $\pm 100ppm$ (Typ.)
- Small package 8-pin SOP

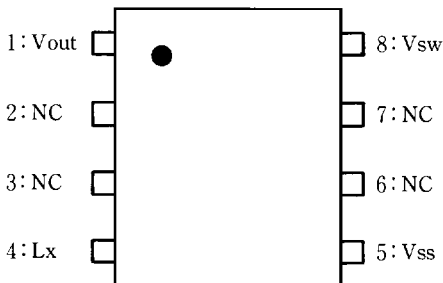
■ Application

- Constant voltage source for battery-operated devices.
- Constant voltage source for cameras, communication equipment, and videos.
- Local regulator for different operating voltages.

■ Block Diagram



■ Pin Configuration



■ Pin Description

Pin No.	Name	Function
1	Vout	Output Voltage
2, 3	NC	No Connection
4	Lx	Switching pin
5	Vss	Ground
6, 7	NC	No Connection
8	Vsw	Step-up Output

■ Absolute Maximum Ratings

(Vss=0V)

Parameter	Symbol	Limit	Unit
Input Voltage	Vin	12	V
Output Voltage	Vout	12	V
Output Current of Lx pin	ILx	100	mA
Power Dissipation	Pd	300	mW
Operating Temperature	Topr	-20 ~ +70	°C
Storage Temperature	Tstg	-40 ~ +125	°C

■Electrical Characteristics

● RF5RD301 (3V Output)

(Ta = 25°C Vss = 0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Voltage	Vin				8	V
Starting Voltage	Vst	No Load	1.2			V
Holding Voltage	Vhld	No Load	0.8			V
Current Consumption	Iin	No Load, Vin = 5V		4	9	μA
		No Load, Vin = 2.4V		7	20	μA
Output Voltage	Vout		2.85		3.15	V
Output Current	Iout	Vin = 5V		40		mA
		Vin = 2.4V		15		mA
Output Current of Lx pin	ILx	Vol = 0.4V	40			mA
Leakage Current of Lx pin	ILxL				1	μA
Oscillating Frequency	fosc		60		90	KHz

● RF5RD501 (5V Output)

(Ta = 25°C Vss = 0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Voltage	Vin				8	V
Starting Voltage	Vst	No Load	1.2			V
Holding Voltage	Vhld	No Load	0.8			V
Current Consumption	Iin	No Load, Vin = 7V		6	11	μA
		No Load, Vin = 3.6V		15	40	μA
Output Voltage	Vout		4.75		5.25	V
Output Current	Iout	Vin = 7V		40		mA
		Vin = 3.6V		20		mA
Output Current of Lx pin	ILx	Vol = 0.4V	60			mA
Leakage Current of Lx pin	ILxL				1	μA
Oscillating Frequency	fosc		100		140	KHz

Note: The above table assumes that L = 120μH (CMD6L), MA721 diode or equivalent, and C = 22μF are used for external parts.

■ Design of DC/DC Converter

To design a DC/DC converter using this IC, the output voltage I_{out} depends on the output current capability of the series regulator when stepping down, and on the step-up capability of the switching regulator when stepping up. Therefore, I_{out} is expressed as follows:

(Step-down)

$$I_{out} = K_p (V_{in} - V_f - V_{out})$$

(V_f = forward direction voltage of diode, K_p = conductance coefficient of transistor)

(Step-up)

$$I_{out} = K_L \frac{V_{in}}{8 \cdot L \cdot f_{osc} \cdot (V_{out} - V_{in})}$$

(for, $K_L = 0.5$ to 0.8)

The following external attachments are recommended for optimum performance:

(1) Coil

- CMD-6L (Sumida Electric Company Ltd.) or equivalent
- CM-5 (Sumida Electric Company Ltd.) or equivalent

(2) Diode

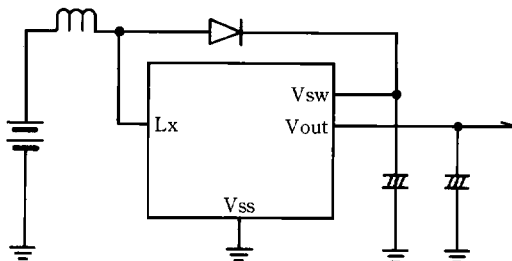
- Shottkey diode

(3) Capacitor

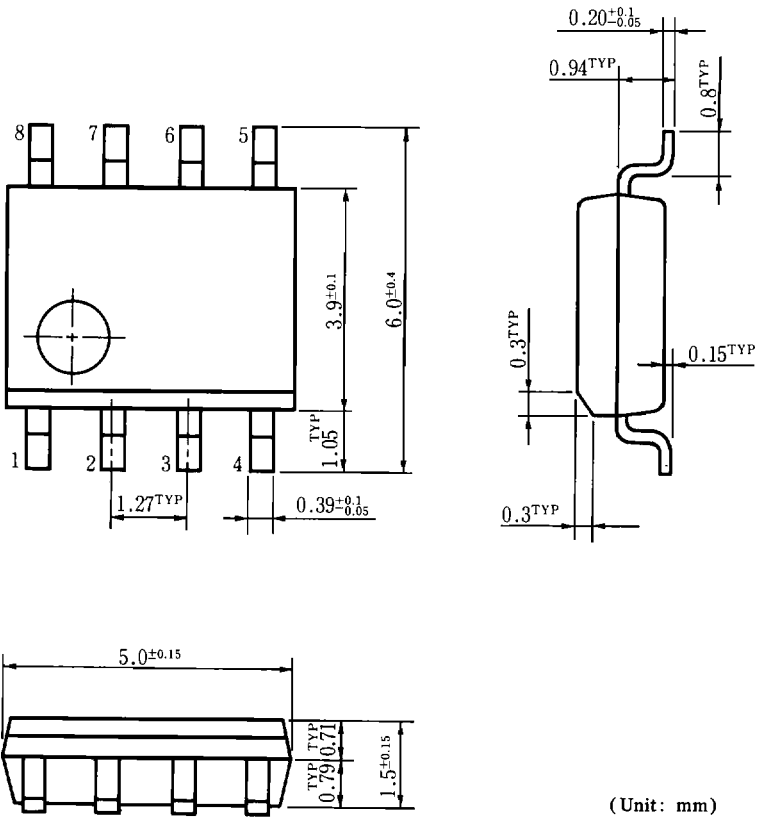
- 22 to $47\mu\text{F}$ or more

■ Application Circuit

Step-up/Step-down DC/DC Converter



■ Package Dimension



(Unit: mm)

